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EDITORIALS

STEEL CONDUCTORS FOR HOUSE WIRING.

In order that the central stations of the country may widen their fields of service, there has been an insistent demand for some time for a cheaper system of electric wiring which would be applicable especially to already-built houses, cottages and flats of the most modest type. The concentric system of wiring, which has been widely applied in certain countries of Europe, has been looked to by many as a system which would meet this demand. It has been widely discussed and a number of trial installations have been made in this country in order to demonstrate its possibilities. To the disappointment of many, these trial installations have not indicated any marked lessening in cost from the figures which would apply to the more usual methods of wiring; in fact, in certain cases the cost has been greater. This was true, for instance, of a Chicago installation described in the issue of August 12. It is to be expected that the labor cost for this type of installation can be decreased as the workmen obtain experience and become more familiar with the work, and the materials will be less expensive when produced and purchased in large quantities. It does not seem likely, however, that such improvements in the cost figures will do more than place the concentric system upon a par with those now regarded as standard.

There is another method of reducing the cost of small wiring installations which has received little or no consideration in this country. Installations in small residences invariably use more copper in the conductors than is necessary from the electrical standpoint, and the high price of copper at the present time makes this item more important than it formerly was. The smallest size of wire that is permitted for either main or branch circuits is No. 14 B. & S. gauge, which has a rated carrying capacity of 15 to 20 amperes, according to the kind of insulation with which it is provided. Wire as large as this is required for mechanical reasons, since a smaller size would be more likely to become broken and lead to trouble and possibly to hazards. The carrying capacity of No. 14 wire is much more than sufficient for most branch circuits, since such circuits are limited to a connected load of 660 watts, which upon a 110-volt circuit, is equivalent to six amperes. Copper is chosen as the material for conducting wires on account of its high conductivity. It is evident here that the conductivity is much higher than is necessary from electrial considerations, and a cheaper material could be substituted without detriment. Such a material can be made available in the form of insulated iron or soft-steel wire. Such a wire would have about seven times the resistance of a copper wire of the same cross-section, and in small sizes the magnetic permeability would be of no consequence in alternating-current circuits of commercial frequencies, so far as reactance and skin effect are concerned.

Not only has No. 14 copper wire higher carrying capacity than is necessary on the typical branch circuit, but the voltage drop due to its resistance is much smaller than would be permissible in good practice. A length of 100 feet of this wire has a resistance of approximately one-quarter ohm, and with a return wire would have a resistance of about one-half ohm. The maximum current of six amperes permitted in a branch circuit would cause a drop of three volts in this length of wire if the load were concentrated at the distant end. For the same drop under the same conditions a soft-steel wire of the same size could be but 14 feet long. If steel wire of size No. 12 B. & S. gauge were substituted, the length of the circuit might be 23 feet, or if the load were distributed along the circuit the length could be even greater.

The maximum load here considered represents eleven 60-watt tungsten lamps, or 26 lamps of the 25-watt size, which would be more frequently found in residences of the type here under consideration. The National Electrical Code, however, permits not more than 16 outlets to the circuit, so that if lamps of this size are used the greatest possible load is not more than two-thirds of that above considered; hence the likelihood of overload or of excessive drop in voltage in case iron or steel wire were substituted for the copper is very remote.

Steel wire is ordinarily drawn in sizes not represented in the B. & S. gauge, but the common sizes of copper wire have been considered above in order to make a comparison. It is really immaterial what exact size of wire is chosen in this connection, but it should be kept in mind that a smaller size of steel wire will meet the mechanical requirements of strength as well as the minimum now permitted in copper wire. On particular circuits where loads might be heavier than the minimum, it will be possible to use copper wire even though steel wire were resorted to upon the smaller main or branch circuits. No change in fittings would be necessitated by the use of steel wire.

It should be kept in mind that with the tungsten

lamps now almost universally used for lighting purposes and especially in new installations, a greater voltage drop is permissible upon the line than was considered good practice when carbon incandescent lamps were generally used. This is due to the fact that the variation in candlepower of tungsten lamps for a given change in voltage is less than in the case of carbon lamps. This variation in fact is only about two-thirds as great.

Electrolytic troubles at the junction of dissimilar conductors could be avoided by suitable junction boxes and the likelihood of rusting of the exposed portions of steel wire at such connection points does not seem to offer serious difficulty. Iron wire has already been used in Germany for this purpose and while some trouble has been encountered, it should be remembered that rubber-insulated wires were not available on account of the scarcity of rubber in Germany at the present time. There is good reason to believe that the use of iron as a substitute for copper will be continued in Germany after the war, on account of the advantages pointed out above. In looking for an innovation in wiring among our European friends, greater advantage in the direction of lessening the cost may be secured following this newer practice rather than that represented by the concentric wiring system.

STANDARDIZATION OF ELECTRICAL SERVICE.

Most of the public-utility laws of the different states confer upon a state commission authority to supervise the service of the utility corporations. In virtue of such authority many of the states have established definite rules governing electric service within their jurisdiction. Up to the present time, commissions in one-third of the states have adopted such general rules to govern all electric lighting and power companies, and special rulings have been adopted in individual cases in other states as well. By many persons the regulation of service is considered quite as important as the regulation of rates, if indeed not more so. We may, therefore, look for a more extended and general exercise of this power by the state commissions.

Intelligent regulation of the service of the utility companies requires a wide knowledge of the elements which go to make up good service. Indeed, the criteria of good service will vary from place to place and from time to time, depending upon individual and local conditions. This knowledge can only be acquired through extended study and investigation. It is notorious that many of the state commissions are unable to make such studies owing to the non-existence of an adequate engineering force and of funds to properly carry out such work. Indeed, the engineering forces of most of the utility commissions are already overtaxed in carrying out other investigations and the inspections which are necessary to be familiar with the manner in which the utilities are already carrying on their operations.

In establishing regulations for electric service in the different states it is desirable that there should be some degree of uniformity in different parts of the country, even though it must be recognized that the same rules may not necessarily be appropriate to all places. There is an advantage, however, in making regulations as uniform as possible, especially to cover cases in which a single utility corporation operates in more than one state. Such measure of uniformity can only be secured by some form of co-operative action, either by the commissions themselves or by a central authority working in conjunction with them all with the object of assisting them as far as possible. A promulgation of such rules intelligently drawn up is an advantage to the utilities concerned and to the public. They make known to the utilities what is expected of them in the way of service and at the same time inform the public as to what they may expect of the utility companies. At the present time there is considerable lack of uniformity in the rules already in operation. For instance, the amount of tolerance permitted in the registration of a meter is widely different in the different states. In some, departure of two per cent from correct registration is all that is permitted for a meter to be correct, while in one state, an error of two and one-half times this amount is necessary for a meter to be considered as registering incorrectly.

Recognizing the need of a general study of this problem, the Bureau of Standards has undertaken a study of it and has recently published a circular entitled, "Standards for Electric Service," an abstract of which was published some weeks ago.[1] In addition to analyzing the laws and regulations of states and cities already in force, this circular presents a set of proposed standards which have been drawn up after a conference with a large number of interested parties, including committees of the National Electric Light Association and the Association of Edison Illuminating Companies. While the proposed standards may not be adopted bodily in any one jurisdiction, they afford a suggestive basis for any commission undertaking to draw up a set of regulations, and as these provisions were acceptable to the committees of the two associations above mentioned, it is probable they would also be acceptable to the electric utilities who would be obliged to comply with them. The proposed meter specifications represent a revision of the Meter Code of the National Electric Light Association and have had the approval of the Joint Committee on Meters of the two associations above referred to.

The requirements governing voltage regulation are somewhat different from any of those which have heretofore been adopted by state commissions. On lighting circuits it is proposed that the voltage shall always be kept within five per cent of the nominal value between sunset and 11 p. m., while the maximum range of fluctuation must not exceed six or eight per cent, according to the population of the community concerned. The voltage variation on power circuits is not to exceed ten

1 See issue of July 15, page 139.

per cent above or below the normal operating voltage.

While the regulations proposed in this circular may not be found suitable for all parts of the country, they will at least be helpful in formulating a code in any state, and to the extent that uniformity in the different states is approximated, an advantage will have been secured. The compilation of existing laws and regulations which is given in the circular will prove very helpful to those interested in this subject.

THE COST OF SECURING CAPITAL.

In public-utility financing the cost of securing money is an important factor in the development of a property. By this is not meant the interest and dividends which are paid on the securities of the company to the stockholder and bondholder and which are essential to make future issues marketable, but we are dealing with the actual costs to the utility of placing its securities in the hands of the public. This cost of securing the money should be distinguished from promotors' services and from bond discount. The latter is an adjustment between the amount paid by the public for the bond and its face value, due to the difference of the interest rate of the bond and the interest rate prevailing at the time of the sale of the bond, and it may occur a number of times during the life of the corporation. The cost of securing money is a very different thing, and only comes once—when the original capital is acquired.

That such costs are legitimate and must be recognized cannot fairly be denied. The existence of numerous banking and brokerage houses specializing in public-utility securities shows that it costs to secure money just as to purchase generators, cable, land or any of the tangible construction elements of a property.

Taking an illustration from the recently argued Bay State Street Railway case before the Massachusetts Public Service Commission, it may be noted that this particular property is made up of 68 operating companies that were incorporated and financed at different times between 1859 and 1900. At the beginning of each company it was necessary to sell securities to investors, and some individual, group of individuals or banking house employed time and money in interesting the investor, consequently being entitled to a legitimate payment in recognition of such services, in commissions by way of either cash or stock. Being untried enterprises, the difficulties of the early broker were of course comparatively great. As the companies developed, additional capital was required, and the costs of securing this additional capital had to be paid, although these costs were unquestionably less in a going concern. It might well be claimed that a considerable allowance should be made for the full cost of all money which has gone into the operating company.

In the Chesapeake and Potomac Telephone case the Maryland Public Utilities Commission recognized such a principle. There the holding company, the American Telephone and Telegraph Company, had furnished money to the operating company at an annual rate of six per cent, imposing also a charge of 4.5 per cent for various services, including the cost of promotion and financing. The Commission approved this charge.

In the Bay State case, one of the benefits brought about through the formation of the holding company (the Massachusetts Electric Companies) was to eliminate such costs to the operating organization, and no claim was made for any such costs since the holding company secured control of the constituent properties, but it was maintained before the Massachusetts Commission that a money-cost allowance of 2.5 per cent should be conservatively permitted on all outstanding capital down to the time of acquisition by the holding organization.

ROUTING THE GAS ARC.

There are but few localities where electric companies find it necessary to compete with gas service upon the basis of cost for an equivalent amount of heat energy or light flux supplied. The competition offered by electric service to its competitor is rather upon the basis of the quality of the service rendered, and the inherent advantages of the electrical agent, such as convenience, ease of control, cleanliness, healthfulness, etc. These advantages exist in all the fields involved—lighting, cooking, heating, and the development of mechanical power.

It is, however, not always easy to convince the prospect of these advantages until an actual trial has been made, and where a gas installation already exists, there is often an unwillingness to incur the expense involved in a change, even when the resulting benefits are recognized. To meet these conditions the electric utility in Cincinnati has taken the bull by the horns and arranged to make trial installations of incandescent electric units without expense to the customer, where wiring is already available upon the premises. In buildings not already wired, this part of the expense must be borne by the owner, but the advantageous offer to exchange an electric unit for the gas equipment is often sufficient to induce the owner to decide that a favorable moment for the long postponed wiring has arrived.

The article by Mr. W. A. Wadsworth in this issue shows that the expense involved in this method is justified by the results, and that a campaign on this basis has resulted in displacing a great many gas arcs, and bringing to the central station much business which otherwise might not have been secured. The method is one which some companies might not find it feasible to adopt, but one which could be followed to advantage in many localities. An important point to be considered is the fact that this campaign resulted in the wiring of 120 stores in two months, in addition to the many installations in premises which were already wired. It is characteristic that when a gas unit is replaced by an electric unit, the change is a permanent one.

Happenings in the Industry

Dallas Franchise Controversy Near Settlement—Extensive Improvements at Nashville—Projected Plant for Denver—Markets for Electrical Goods in Far East to Be Investigated—Indianapolis Building Lighted by Reflected Light—Illumination to Be Feature of Cleveland Exposition—Rejuvenation at Cleveland—Industrial Organization Necessary

Dallas Controversy Near Settlement.

A compromise settlement of the Dallas, Tex., street car and electric light controversy is indicated in recent actions that have been taken by the city and by Messrs. Strickland and Hobson who have been chosen to head the new lighting and traction companies respectively.

The city has been contending for a valuation basis of $7,100,000 as found by Edward W. Bemis, while the proposed heads of the new companies have been contending for a valuation basis of $8,500,000. Practically all other conditions proposed by the city have been met and in addition the following promises have been made by Messrs. Strickland and Hobson:

(1) To spend not less than $2,000,000 in improvements and extensions in street railway and lighting equipment within 18 months after new franchises become operative.

(2) To build two new interurban lines into Dallas, one immediately upon new franchises becoming operative and the other as soon as street railway receipts are up to the 1913 mark.

(3) Estimated expenditures in and around Dallas to be $5,000,000 within three years.

(4) Immediate net rate on lights of eight cents per kilowatt-hour, and a rate not to exceed seven cents per kilowatt-hour after November 1, 1917.

(5) The sliding scale of light rates by which companies are not allowed to increase rate of return on investment until they have reduced cost of lights, thereby stimulating constant effort on part of companies to keep down operating expenses.

(6) Valuation on the two properties of $8,500,000.

(7) Interurban terminal to be put into the new local street railway company and not be under the control of the Dallas Electric Company of Maine.

A straw vote is now being taken in order that the people may decide whether they want to accept the offer of Messrs. Strickland and Hobson. If this straw vote is favorable, franchises will be granted tentatively, pending confirmation at the polls next April.

Nashville Company Makes Two Important Transforming Installations.

The Nashville Railway & Light Company has completed two installations of transforming equipment that are intended to aid the operation of its railway system.

One of these is a 2,000-kilowatt motor-generator set, installed at the central station. This consists of a 2,800-kilovolt-ampere, 2,300-volt, three-phase synchronous motor, direct-connected and unit-mounted with a 2,000-kilowatt, 600-volt generator and 150-kilowatt, 250-volt exciter. This replaces two 500-kilowatt and one 1,000-kilowatt rotary converters. The new equipment acts as a compensating condensor for the regulation of the voltage and also eliminates flashovers from fluctuations in the pressure, such as may happen to a rotary at the end of a long-distance transmission line. The motor-generator set is connected to the station buses, and can be driven either by the local steam units or by energy from the Tennessee Power Company's Ocoee hydroelectric plant. The new equipment is designed to take care of a 50-per-cent overload, so that the peak load of the railway traffic may be cared for without surplus installation, on the basis of a fairly average load. The new switchboard panel, which replaces the one used for the equipment superseded, matches existing switchboard equipment throughout.

A 500-kilowatt motor-generator substation has also been installed to improve service on the West Nashville lines, which were formerly operated by power from a seven-mile transmission line. As a result considerably faster schedules have been arranged. This motor is also synchronous. The high-tension line is operated at 13,200 volts, 60 cycles, three-phase and the motor is rated at 700 kilovolt-amperes, with a 500-kilowatt generator and 11.5-kilowatt exciter, unit-mounted. The set is capable of running continuously for 24 hours and of running two hours on 50-per-cent overload. Both installations were made by J. L. Bailey, of the company's staff. Harry Badger is superintendent of power.

New San Bernardino Substation for the Pacific Light & Power Corporation.

The Pacific Light & Power Corporation, operating at Los Angeles, Cal., and vicinity, has recently completed a new substation on C Street, San Bernardino, adjoining its former plant in that locality. The new station consists of three 1,000-kilovolt-ampere transformers of General Electric Company outdoor type, reducing the voltage as received from the Pedley-San Bernardino high-tension line from 60,000 to 15,000 volts. Connection with this transmission line is made by means of an oil switch and top pole switch on the 60,000-volt side, and to either or both of the two 15,000-volt buses in similar manner.

All wiring and top pole switches are carried on steel towers, with suitable housing for the oil switches in the bases of the towers. Electrolytic lightning arresters are provided for both the 60,000 and 15,000-volt sides of the transformers, protecting them from any excessive potential surges. The switching towers and transformers are enclosed in a 10-foot wire fence to prevent accidental contact, and to guard the public from the station a board fence has been constructed entirely around the property. Three 15,000-volt lines from the station cover the system to Pedley, Highgrove and for service to the Pacific Electric Railway.

New Water-Power Plant May Serve Denver.

Stockholders of the Rocky Mountain Hydro Electric Company, a corporation owning valuable water rights on the North St. Vrain River in northern Colorado, held a meeting in Lyons, Colo., recently. The purpose of the meeting was to discuss the construction of a hydroelectric plant at Swift's ranch, about 11 miles from Lyons.

The original plans of the company called for the construction of a large hydroelectric plant at Swift's ranch where the company has held filings on a reservoir site and water rights for several years.

One of the stockholders says construction work on the project will be started as soon as water-power legislation now pending in congress is definitely known. The cost of constructing the reservoir, power house and transmission lines to Denver is estimated at $1,000,000.

Utility Participates in Parade.

This summer when Denver, Colo., held a "clean-up and paint-up" parade the Denver Gas & Electric Light Company helped by taking a number of its electric delivery trucks and filling them with small boys, as shown in the

Denver Central-Station Employees in Parade.

accompanying photograph, and joining the procession. Of course, the part of the parade furnished by the light company attracted a great deal of attention and resulted in advertising for that concern. It also showed the Denver Gas & Electric Light Company to be a public spirited company—one always ready to aid a good cause when it would result in good coming to the city in which it does business.

Extensive Construction Work Planned by Alabama Power Company.

Official announcement has been made by the Alabama Power Company that during the fall it will spend more than $1,000,000 on new construction in Alabama. The company will build substations at a number of points, erect about 100 miles of transmission lines and enlarge the gas plant at Anniston. The company has already made plans for the construction of a steam auxiliary plant in Walker County, Ala., and a hydroelectric plant on the Coosa River at Lock 12. A high-tension line will be built from Gadsden to Guntersville, Decatur, Huntsville and Gurley in the northern part of the state. It is understood that the company will purchase the Gadsden street-railway system. It is intended to extend another line from Alexander City to Opelika where a large cotton mill is to be opened, to be operated by electric power. Substations will be erected at points along these lines.

Markets for American Electrical Goods to Be Investigated.

The Bureau of Foreign and Domestic Commerce, United States Department of Commerce, has selected R. A. Lundquist, consulting engineer, of Minneapolis, Minn., to study the markets for electrical goods in China, India, Australia, South Africa and a number of other countries in the Far East.

Some years ago American electrical goods met with considerable competition in the Far East, but the war has greatly handicapped the principal European competitors, and American manufacturers are making a serious effort to take advantage of the situation and get permanent possession of the markets. A great deal of preliminary study is still needed, and Special Agent Lundquist's part in the campaign will be to ascertain the types, qualities and costs of electrical apparatus with which American goods come into competition, as well as to look into the general opportunities for the sale of such goods. Before leaving on the trip the special agent will spend some weeks in the principal business and manufacturing centers conferring with manufacturers, exporters and business houses on the scope of the investigation.

Illumination of an Indianapolis Building by Reflected Light.

A building illuminated by reflected light is a present-day fact. This peculiar lighting effect is to be seen in Indianapolis. The W. H. Block department store, a structure eight stories high, occupying a quarter of a square, stands out resplendently against the night sky. This white terra-cotta building looms up beautifully at night from the reflected light of the "Soldiers' and Sailors' Monument," approximately 650 feet away. This shaft to Indiana's silent soldiers was flood-lighted for the first time on July 4 by the Merchants' Heat & Light Company.

This great monument of Indiana limestone 284 feet high with bronze astragals inserted about the center was completed in 1905 at a cost of $600,000, and is considered one of the finest pieces of architecture and sculpture work in the world.

The diameter at the base is 110 feet, tapering at the top to a diameter of 13 feet 3 inches.

Through the efforts of R. A. MacGregor, salesmanager of the Merchants' Heat & Light Company, there were installed four batteries of flood-lighting projectors of 25 each, placed on the roofs of buildings facing the monument. Each projector contains a 250-watt gas-filled flood lamp and projects a beam of light of 100,000 candlepower.

The projectors were placed 230 feet from the monument and produced an intensity of 4-5 foot-candles uniformly distributed over the entire surface of the shaft. The total wattage used for illuminating the monument is 25 kilo-

Indianapolis Building Lighted by Light Thrown on Nearby Monument.

watts. To add to the beauty of the lighting, eight additional projectors were installed with red and blue lenses to illuminate the cascades on two sides of the fountain and create an iridescent effect on the water.

This remarkable night spectacle of flood-lighting has received favorable comment throughout the country.

Colorado Commission Orders Increase in Rates After Public Hearing.

Last week the Colorado Public Utilities Commission issued an order granting the Colorado Springs Light, Heat & Power Company permission to increase its charges for gas from $1.10, gross, and $1, net, to $1.15, gross, and $1.10, net, for the first 5,000 cubic feet consumed each month.

This is the first case in which the public utilities commission has permitted an increase in rates to a corporation after a public hearing. The company wanted to increase its rates to $1.35 and $1.25, but the commission held that it would be in excess of the value of service received. The permission for the increase in rates was granted on the company's showing that it was not earning a fair rate of return upon its gas property. The change will only result in a small increase in its gross revenues, but the commission held that a raise which would insure the company a fair return upon its investment would necessitate fixing a rate greatly in excess of the value of the service rendered.

In a previous case the commission held a general investigation into and hearing upon the rates, regulations, rules practices of the company, and ordered a material reduction in electric lighting and power rates charged. This reduction has been in force several months and has saved thousands of dollars to the residents of the Springs, at the same time increasing the patronage of the company. In the same case, however, it was found that the value of the company's gas properties to be $710,917 for rate-making purposes as against a net return of $8,239.90 per annum, or only 1.16 per cent on the investment.

Illumination to Be Feature of Cleveland Industrial Exposition.

The West Side Chamber of Industry of Cleveland, O., will hold an Industrial Exposition and Fair, September 2 to 9, inclusive. The exhibits will be located in nine large tents now being erected on the lake front just north of Edgewater Boulevard in Edgewater Park, on the west side of the city. The exposition will cover about 14 acres, the tract of land being about 1,500 feet long and varying in width from 200 to 400 feet. The use of the land was donated by the city. In addition to the nine large tents mentioned above, there will be about 200 tents of varying sizes to house the different concessions, besides other tents for offices, rest rooms, etc. This is the first time that an affair of this size has been housed entirely under tents in this section of the country.

A feature of the exposition will be the electrical illumination, the installation of which has been placed in the hands of the Vedder Electric Company, 305 Pythian Temple, Cleveland. The cost will be about $10,000. Four hundred direct lighting units equipped with ten-inch Sudan glass reflectors will be used for lighting of exhibits. Nitrogen-filled lamps from 250 to 500 watts will be used in these fixtures. One hundred flaming arc lamps will be used for general illumination of the grounds. Festoons of lights will be strung the full length of the grounds along the boulevard side. A large searchlight placed on the roof of one of the nearby factories will add to the illumination. Local and out-of-town engineering societies interested have been invited to view the lighting installation. Complete data are not available at the present time, as the work is not yet completed.

Vermont Capital City Contracts for Public Lighting.

The city council of Montpelier, Vt., has voted to make a seven-months' contract with the Montpelier & Barre Light & Power Company for the lighting of the city streets and public buildings, pending the question of entering into a 10-year contract after consideration in the spring at the annual city meeting. The short-term contract is higher in its rates than the proposed 10-year contract, but if the voters accept the latter, the terms of the earlier contract will be made the same, and the difference rebated.

The contract calls for 20 400-candlepower incandescents with prismatic reflectors, at $66.63 per year per lamp; 104 arc lamps, at $65, and 81 60-candlepower incandescents, at $19.60; the company to install all lights.

If a 10-year contract is executed, the rates will be $60 per 400-candlepower incandescent. The city voted to floodlight the city hall with 10 projectors.

Cleveland Jovians Hold Rejuvenation.

Cleveland Jovians, assisted by a delegation of Jovians from Sandusky, O., held a rejuvenation Saturday afternoon and evening of August 19 at Nela Park, Cleveland, O., the summer camp of the National Lamp Works.

The initiation, conducted by the Sandusky team, took place in the open air among the trees. The natural surroundings together with the lighting effects and the wording of the ritual, made a lasting impression upon the candidates. The work of the Sandusky degree team, considering the fact that this was only their second attempt, was good, the work of H. H. Squire as Pluto being particularly pleasing. The following Jovians composed the team: M. J. McCabe, Jupiter; H. H. Squire, Sr., Pluto; Roy Rohrbaugh, Neptune; R. G. Sloat, Hercules; H. H. Squire, Jr., Mars; J. M. DeMay, Vulcan; R. C. Beebe, Apollo. In addition to the members of the team the following Sandusky Jovians were present: M. A. Lockwood, Ray Patterson and E. A. Bechstein.

Group of Cleveland and Sandusky Jovians at Nela Park After Rejuvenation.

INDUSTRIAL ORGANIZATION IN THE ELECTRICAL INDUSTRY.

Co-Operation Necessary in Order to Meet After-War Competition.

It is generally conceded that at the close of the European war there will be necessary a complete readjustment of trade conditions and a concerted effort on the part of American manufacturers to meet the keen competition which will arise. The gospel of co-operation is an old story to the electrical industry but at no time is co-operation in its fullest sense more essential than at present. Some new ideas on the subject are contained in the current issue of *Trumbull Cheer*, the house organ of the Trumbull Electric Manufacturing Company, and we quote herewith paragraphs which contain food for thought.

The one real thing that awes a politician is organization. Personal appeals or opinions roll from the average political back as water from the duck.

Organization is collective co-operation.

A collection of men who assemble under a name is not an organization unless there be a tie that binds—co-operation (the give and take) is that tie.

Members of a given association no more form an organization than do members of a town unless the spirit and sense of community interest impresses itself upon their business thoughts and acts.

There is a lot of hocus-pocus about many alleged organizations.

Standardization is the essence of organization.

Common counsel must prevail and local prejudices must be subordinated. General concern must strongly influence private interests and considerations, if an organization is to accomplish its ends. The possible or even assured individual benefit of today must yeld to the co-operative benefits of the future if any organization is to accomplish more than a negation of its objects.

We have a number of organizations among the various branches of the electrical field—among jobbers, contractors, central stations, engineers and manufacturers.

Each has an object—many objects. Each has its needs, demands, hopes, faults, advantages, handicaps and virtues. Each is promulgated to help its members through common counsel and to exchange experiences and opinions.

A large part of the value of each such organization is subjective rather than objective.

There is more work to do toward the self improvement of the membership than in an endeavor to control the doings of those in allied departments of the field.

The jobbers have about all they can do to make themselves the great selling powers of the electrical field without trying to lay down too many laws for manufacturers.

Contractors have too much to do in digging out business, getting out and doing their work and cleaning out the curbstone element to fight the jobber or "cuss out" the manufacturer.

The manufacturer has a vast field to cover along lines of standardization of lines, lists, methods and problems of distribution without trying to play the part of Moses to the jobber and contractor.

Theoretically there should be no conflict worth mentioning between these three divisions in the electrical field. In fact, the ideal organization would be that which combined and functionalized all three of these branches (with the central stations added) into one big co-operating whole. But heaven is not yet upon earth.

If the different branches can work together toward better understanding of and respect for each other, heaven will be approaching us. Old and the new firms, large and small firms, should meet in common counsel and with mutual respect.

Of course this all sounds very nice.

There are some methods and men you cannot respect and will not tolerate. They should not be permitted in an organization which stands for other things.

I have seen jobbers try stunts that would make their fellows in the jobbing game "sick abed." When one plays a mean trick on a manufacturer or on a contractor he is automatically an enemy to his fellow jobbers and they should censor him more severely than do the men he has ill treated.

Internal, mutual discipline is as important in an organization as is the mutual exchange of courtesy.

Manufacturers who ignore trade standards and disrupt legitimate business conditions or try so to do become automatically the enemy of every department in the field, because every department in the end is adversely affected.

Back of a very large percentage of trouble arising between members of an organization can be traced the lack of cost knowledge.

Particularly is this true among manufacturers.

But when we contemplate the action of certain jobbers and contractors we feel that their own particular divisions have much to contend with on this line.

The cost of doing business is only one factor.

Business organizations need to realize that conditions are changing rapidly—never to be the same again. There is no "in statu quo."

There are still those among jobbers, contractors and manufacturers who refuse to recognize the changes that time has brought and will continue to bring, and who desire to be let alone to do business in the same old way, and who spend time inveigling against laws and restrictions, supervision and control and other conditions come to stay.

This all applies in its modified form to the electrical industry. For years profits were large—demand no greater than supply—whereas today (barring the present conditions which we all know are temporary) there is plenty of supply, plenty of copper (don't worry), whereas today, profits are strictly normal or subnormal—the field is plenty crowded.

We men must prepare for the readjustment days to come—we must keep our credit sound, keep our leaks closed and be ready to face new conditions through which the ill-equipped and financially weak member cannot navigate.

Our various associations must be organizing, teaching bodies and we must prepare to meet world competition and readjustment of we know not what a nature—"after the war."

Light Furnished Through Rotary Converters Must Be Charged at Power Rate in New York City.

A decision of considerable moment to the industry was recently handed down in a case before the Public Service Commission of the First New York District.

There does not seem to be any standard practice as regards the use of rotary converters and motor-generators. In some states the commissions have said that the lighting rate must be charged, but in a number of other cases the rate is that for power.

The latest opinion states that "no electric lighting concern may charge a customer for current at the rate for illuminating purposes even if the current is used to operate a motor intended to produce illumination." The question came up on the complaint of the Vaudeau Amusement Company of 4,705 Fifth Avenue, Brooklyn, which complained of the rate charged by the Edison Electric Illuminating Company.

The hearing was held by Commissioner Hayward, who decided that the current furnished by the company was for power because it was only needed to run a motor. The fact that the motor was used for lighting purposes made no difference. Under the decision the company will have to reduce its rate to that charged for current for power purposes.

Miscellaneous NEWS NOTES

Minors Prohibited From Testing Electric Meters.—The State Industrial Board of the Pennsylvania Department of Labor and Commerce has adopted an order prohibiting boys under 18 years of age from being employed in testing electric meters.

Utility Company's Band Gives Concert to Residents Near Its Central Station.—The Commonwealth Edison band, an organization maintained by the Commonwealth Edison Company, Chicago, Ill., gave a concert August 24 for the benefit of the community near its Northwest station. The concert was given on the station grounds, and the residents of the section near the station appreciated the opportunity of attending because there are no public parks where band concerts can be given in that immediate vicinity.

Chattanooga Company Establishes Division Offices.—The Public Light & Power Company, Chattanooga, Tenn., has established division headquarters at Winchester, Tenn., with J. A. Foster as superintendent and D. D. Good as manager of new business and merchandising. Track City, Sewanee, Monteagle and Cowan are included in the new division.

Silk Machinery to Be Exhibited at New York Electrical Exposition.—One of the features of the 1916 Electrical Exposition which will be held in Grand Central Palace, New York City, October 11 to 21, will be an exhibit of the manufacture of silk. One of the well known manufacturers of silks, H. R. Mallinson, 251 Fourth Avenue, New York City, will supply all of the equipment and machinery for this exhibition. The looms and other machinery will be driven by electricity.

Manufacturing Concern Prohibited From Doing Electric Lighting Business.— A manufacturing corporation cannot do business as an electrical corporation, according to the opinion of the Public Service Commission of the Second District of New York, and the Commission has been compelled to refuse its approval of a franchise for an electric plant and distribution lines granted to the Brooklyn Cooperage Company by the town of Salisbury, Herkimer County. The company is organized as a manufacturing corporation under Chapter 40 of the laws of 1848 for the purpose of manufacturing and selling barrels and everything incidental thereto. The attorney-general has recently held that a corporation organized under this law is without power or authority to carry on an electric lighting business unless it has that specific power under its charter.

Annual Outing Given by Nashville Company.—The Nashville (Tenn.) Railway & Light Company gave its annual outing for its employees on August 17 at Glendale Park, a summer park controlled by the company. Five thousand people, including the employees of all departments and their families, were present and participated in a varied program, which included races and other games for children, a barbecue, band concerts and other festivities. The affair was under the direction of F. W. Hoover, general manager; B. V. Edgar, general superintendent, and H. A. Davis, railway superintendent.

Idaho Hydroelectric Companies Are Merged.—A number of large electric power concerns of Idaho have been merged with a capitalization of $17,000,000. The principal companies affected by the deal are the Idaho-Oregon Light & Power Company, the Idaho Railway, Light & Power Company, the Great Shoshone & Twin Falls Water Power Company, the Southern Idaho Water Power Company, the Jerome Water Works Company and the Idaho Power & Light Company. The officers of the new corporation are: F. F. Johnson, of Boise, president; William T. Wallace, vice-president and general manager; George E. Claflin and D. F. McGee, of New York City, vice-presidents; H. H. Burton, of Boise, secretary and assistant treasurer; E. A. Wetmore, of Boise, treasurer and assistant secretary; E. P. Summerson, of New York City, assistant secretary and assistant treasurer, and A. E. Smith, of New York City, assistant secretary and assistant treasurer.

Large Electric-Heating Installation at Toledo.—The electric-heating department of the Toledo Railways & Light Company, operated by Henry L. Doherty & Company, is at present installing in two plants of the Auto Lite Company, of that city, four continuous baking ovens. The installation of the ovens will cost approximately $30,000, and will mean an additional load of 900 kilowatts for the Toledo company.

Commission Rules Telephone Contracts Should Be on a Uniform Basis.—In a recent order in the complaint filed with the Public Service Commission of the State of Washington against the Pacific Telephone & Telegraph Company, the Commission expressly denies the right of the company to serve telephones under special contracts, ruling that all service must be on a uniform basis. The ruling will affect about 8,095 telephones, and the Commission by this ruling disposes of more than 100 complaints relative to rates and service. The telephones affected are all in the smaller communities.

Shade Trees Responsible for Poor Lighting.—Low hanging limbs on shade trees in Danville, Ky., are held responsible for unsatisfactory street lighting there. When the matter was brought up at a recent meeting of the City Council it was decided that each councilman would be authorized to proceed with a plan for proper trimming of the trees in his own ward. New street lights at a number of points were ordered.

Franchise Renewal Indefinitely Postponed.—The City Council of Seattle, Wash., has indefinitely postponed the request of the Puget Sound Traction, Light & Power Company for a renewal of its franchise to supply power and heat to office buildings and other establishments on Western Avenue and several other business streets. The application was made under the name of the old Seattle Electric Company. It is claimed by the franchise committee of the Council that the franchise in its present form is obsolete, and practically removes the Council's control. The public utilities department is making a report on the company's activities in the matter. The Company is now operating without a franchise, which expired a year ago.

Telephone Pioneers to Meet.—The sixth annual meeting of the Telephone Pioneers of America will be held in Atlanta, Ga., October 19 and 20, with headquarters at the Georgian Terrace Hotel. A business meeting will be held the morning of October 19, papers will be presented in the afternoon, and in the evening the annual banquet will be given by the American Telephone & Telegraph Company. The following day will be occupied with automobile trips in and around Atlanta. R. H. Starrett, 195 Broadway, New York City, is secretary of the organization.

Detroit Edison Company to Install Large Generating Unit.—The Detroit Edison Company is at the present time installing another 20,000-kilowatt generating unit in its Connors Creek plant, the unit to be in operation in October of this year. Last fall the company ordered a 50,000-kilovolt-ampere General Electric turbogenerator, which will be delivered next spring and will be set up at Delray as the first turbine unit of the No. 3 power house there. This turbine will be supplied with steam at 210 pounds pressure from the boiler plant in the No. 2 power house, where there is an excess of boiler capacity, but later it will be served from the boiler plant at the No. 3 power house and at a higher pressure not yet decided. The plans for the No. 3 power house contemplate four units of 50,000-kilovolt-ampere capacity and 16 boilers, though definite plans call for only the installation of one unit during 1917. This unit is expected to operate at 90-per-cent power-factor and deliver 45,000 kilowatts.

Electricity in Marble-Quarrying Operations

The Relation of Electric Drive to Operating Conditions in Quarries, Mills and Shops, and the Factors Which Influence the Selection of Electric Power and Equipment

Industrial Power Series—Article No. 176.

THE superiority of electricity over any other form of power for marble-quarrying operations has been demonstrated in recent years. Differences in transmission and transformation losses and the higher efficiency of electrical machines in general are the most important reasons why the power consumption of electrical machines is less than other machines used in quarrying operations. Convenience of operation is another factor in favor of the use of electricity. Wire is a more convenient means of transmitting power than pipes or hose. Steam requires pipes with flexible joints for operating channeling machines. Steam pipes are often in the way and there is considerable loss of time in adjusting them in proper position. Compressed air may be transmitted through flexible hose, which is more easily adjusted than steam pipes, but transmission by wire is more convenient than either. If quarry operations are carried on in tunnels, electricity is especially desirable. Moreover, with electrical operation the percentage of loss in transmission can be determined and kept within small limits. With either steam or air there is a continual struggle with leaks, and radiation and transmission losses are usually excessive.

Types of Power Plants.

In a recent bulletin issued by the United States Bureau of Mines on the technology of marble quarrying, the statement is made that the following types of power plants have been observed in marble quarries in the United States: (1) Steam only; (2) steam for channelers and tripod drills, with auxiliary air compressor for hand drills; (3) compressed air generated by steam and conducted to the quarry by pipe line; (4) electricity developed by steam; (5) compressed air developed by purchased electric power and transmitted to the quarry by pipe line; (6) purchased electricity transmitted directly to the quarry; (7) hydroelectric power plants owned and operated by the quarry company, the electricity being transmitted directly to quarry machinery.

If quarrying operations are extensive and sufficient and water power is within easy distance, it is probable that a hydroelectric plant owned and operated by the company is the best source of power, although the first cost may be high, especially if large dams must be built. Where an abundant supply and a good head of water may be obtained with a small outlay of capital, hydroelectric power may be cheaper than steam even though the cost of coal is low. The convenience in transmission of electricity has induced some companies to develop it by steam in places where there is not a sufficient water supply.

Uniformity of water supply is an important factor. If during certain seasons, the water supply diminishes and it thus becomes necessary to construct auxiliary steam plants or to shut down operations for a part of the season a hydroelectric plant is of doubtful advantage. Moderate variation in supply may be overcome by constructing a large reservoir.

In central Vermont three hydroelectric power plants

Polishing Machines in a Finishing Shop. Group-Driven by a 50-Horsepower Motor.

Double-Lever Channelers, Each Driven by a 220-Volt Series Direct-Current Railway-Type Motor.

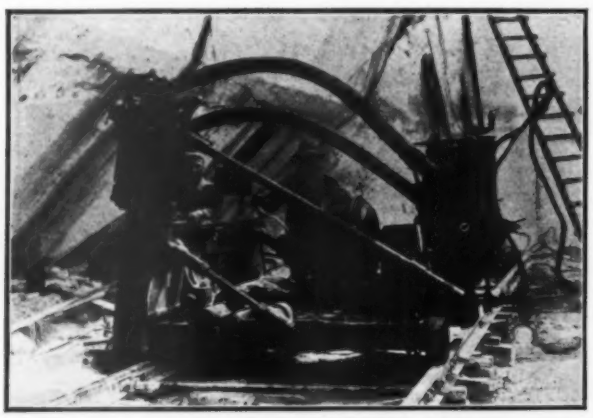
supply most of the power required. Auxiliary steam plants supply additional power in times of low water. Transmission lines pass along the great marble valley for a distance of 62 miles. Power from various supply stations is turned into these lines and is drawn off at the quarries and mills scattered up and down its length. The power line is comparable with a great reservoir, into which water is pumped, and from which it is drawn off by pipe lines to supply various needs.

A Colorado marble company operates a hydroelectric plant with a 380-foot-head of water. Pipes are laid up the mountain side and intercept streams at a high level. Consequently only small dams are required. Under such conditions a power plant can be established with a relatively small outlay of capital.

If electrical power can be obtained from a power company operating large central stations at a cost not exceeding 1.5 cents per kilowatt-hour, it is probably better to purchase power than to erect a power plant at the quarry. If there are no available power lines, or if electrical power costs on the average more than 1.5 cents per kilowatt-hour, and if the power required is 300 horsepower or more, it is probably more economical to erect a steam-driven generating plant at the quarry, provided the engine is of the condensing type. With coal at not more than $3 per ton such a plant can be operated economically.

At one quarry where the installation has a capacity of 500 kilowatts, with an average maximum load of 400 kilowatts, diminishing at night to 200 kilowatts, the total cost of power delivered on the main bus bars of the generating station is less than one cent per kilowatt-hour. Coal at this quarry costs a little more than $2 per ton.

The important point is that new quarries should adopt



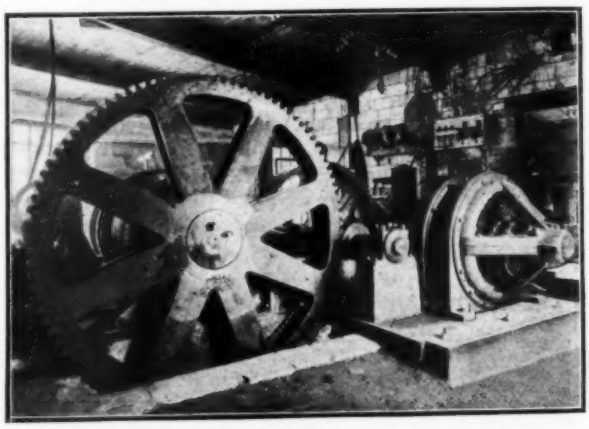
Electric-Air Channeler Driven by a 12-Horsepower 720-Revolutions-per-Minute Induction Motor.

electrical operation from the outset if its adoption will be feasible at any stage of development. Energy should be obtained in the most economical manner possible, and the determination of the source necessitates close consideration of the requirements of a quarry as well as investigation of the sources by which energy for the most economical operation may be derived.

Electricity in Quarrying.

Quarrying operations in the early days were carried on to a great extent with manual and animal labor, and the shops and mills were operated at first by water power, which was, in many cases, supplemented by steam drive. About 40 years ago improvements began to be made in the methods of power application, and at the present time practically all of the numerous properties are provided with modern electric distribution systems, and electric motors are utilized for the operation of all forms of machinery in quarries, shops and mills.

An interesting example of the reliability of electric motor drive is found in double-lever channelers. These machines are provided with long chisels set on either side of a strong framework and actuated through gearing by a 12-horsepower railway-type, direct-current motor. Obviously the motors, which are mounted directly on the channelers, must be unavoidably and continuously subjected



Hoisting Equipment for Derrick, Showing 165-Horsepower Main Hoist Motor and Six-Horsepower Derrick Swinging Motor.

to a considerable amount of vibration when the channelers are in action, but in spite of these severe conditions the original outfits installed in 1896 are operating regularly on flat cutting and with unimpaired efficiency after an active service of nearly two decades. These machines are limited to work on surfaces that are practically level.

As the various arrangements of marble strata require frequent operation of channelers at various angles to the horizontal, another type has been developed and is in common use. This is equipped with only one chisel gang, having a positive reciprocating motion, by means of compressed air supplied from a motor-driven compressor on a closed circuit. The whole is a self-contained and adaptable unit and all necessary speed adjustments can be obtained through the motor controller.

Electric air drills are used to supplement the channeling process by drilling holes along the natural cleavage line, making it possible to loosen the blocks by wedges or levers. No blasting is required, quarrying being done entirely by machinery. They operate on the same principle as the electric-air channelers, but the drill proper and the motor-driven air compressor are separate portable units connected only by flexible air tubing. The load conditions are not severe, and the compressor is direct geared to a two-speed, 5.5-horsepower induction motor.

While most marble quarries are open workings from

which the blocks can be removed by derrick hoists, some of the quarries extend underground for a considerable distance, and have pillar supports for the roof and hanging walls, entailing work similar to that encountered in mining. An example of this is in a Vermont quarry where the workings have been carried to a 300-foot depth, the opening at that level exceeding 2,000 feet in length. In this quarry an electric locomotive is used to haul the blocks from the working face to the base of a slope hoist which elevates them to the surface. The locomotive is operated on direct current, 230 volts, supplied from a motor-generator set to a guarded feeder wire running along one side of the track about 18 inches from the ground.

In the underground galleries referred to above, an artificial circulation of air is provided by a six-foot upcast fan located on the surface and belt-driven by a 40-horsepower induction motor. Where daylight is insufficient for quarrying operations illumination is provided by 250-watt Mazda lamps.

Underground water is frequently encountered in quarrying, and as the shafts are practically unprotected surface drainage and seepage must also be provided for. The pumping sets used for this work include both reciprocating and centrifugal types driven by induction motors. For temporary use, small portable pumps driven by two-horsepower motors are available. The stationary units do not require more than 35 horsepower, as the operating head in rare cases exceeds 350 feet and the load demand is not heavy.

Hoisting Equipment.

While slope hoists are used to some extent in handling the marble after it has been quarried, it is the usual practice to employ simple derrick hoists. These are equipped with hoisting motors ranging from 25 to 165 horsepower, with smaller motors, usually about six horsepower, for swinging the derrick. Steel derrick masts with steel girder booms are used to a great extent.

One of the accompanying illustrations shows a typical outfit for the derricks. A slip-ring induction motor is geared direct to the main hoist, while on the wall at the rear is a panelboard supporting a switch, circuit-breakers and the contactors through which the motor resistance is controlled. The resistance units and motor controller are located on the floor near the panelboard and the small derrick-swinging motor may be seen at the left.

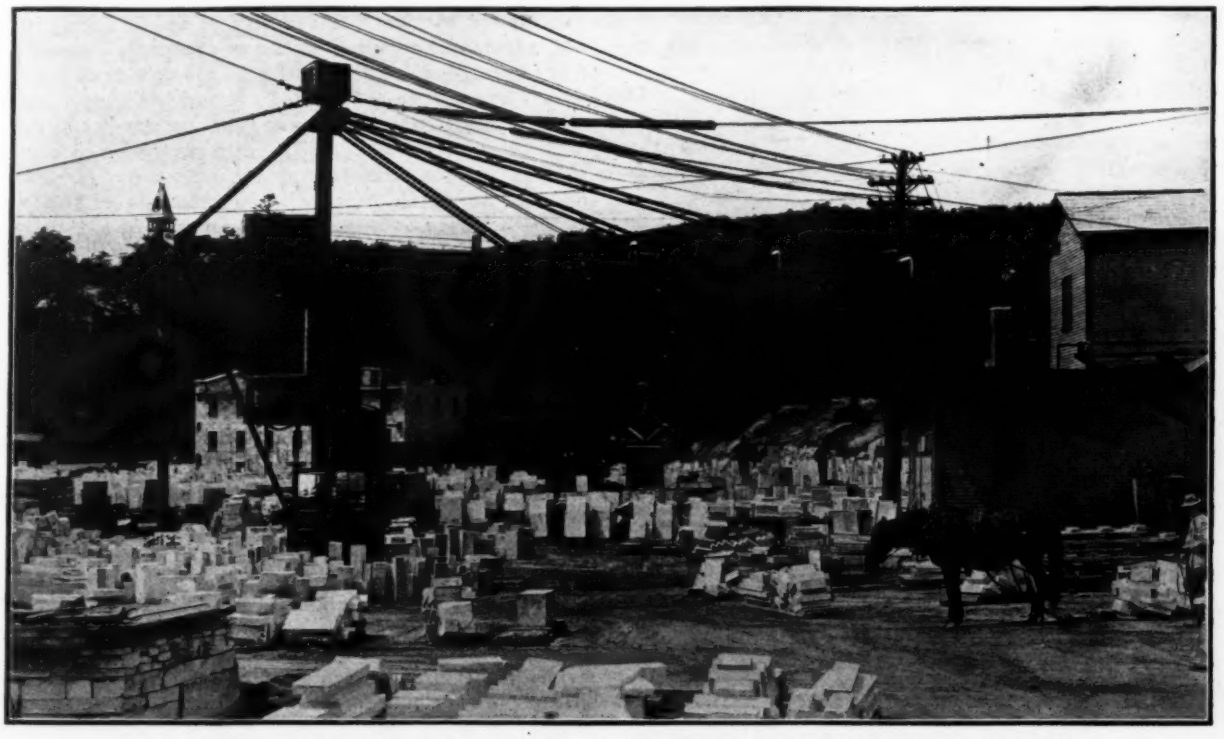
Derrick service is ordinarily intermittent. Many derricks are used with frequency, but in most cases they remain idle for considerable periods. Electric drive permits usage at any time, yet power is consumed only when the derricks are in operation and in direct proportion to the amount of work performed.

When the marble arrives at the surface, it is loaded on flat cars and goes to the mills or to the storage yards for future use. In the latter case it is usually transferred by an electrically operated gantry crane. These cranes are operated by direct-current motors, one on the bridge and two on each trolley, one for hoisting and one for operation of the trolley. It is customary to have two trolleys on each crane, the capacity of which is usually 50 tons.

Sawing Operations.

The sawing of the marble blocks is accomplished by means of gang saws, which are toothless and made of soft iron about 0.125 inch thick and four inches wide. Sand and water are fed to the saw cuts and the rigid framework containing the saw is given a horizontal reciprocating motion. The sand does the cutting. The gangs are driven in groups comprising from 12 to as high as 43 gangs and the driving motors ranging from 75 to 250 horsepower. For every 14 gangs about 100 horsepower is required, which includes power for the sand pumps. Constant-speed squirrel-cage motors have been adopted for this service, although a few wound-rotor motors are used for starting duty. The motors drive through overhead countershafts and are belt-connected, though some are direct-connected. Extreme fluctuations occur in starting and under load, but the group arrangement has an equalizing effect that imposes a very steady load on the motors, whose power factor is normally maintained at from 80 to 85 per cent.

The marble passes from the mills to the furnishing shops, where the rough surfaces left by the saws are smoothed on



A Typical Three-Motor Swinging Crane Used in Handling Finished Marble for Storage or Shipment.

Motor-Driven Gang Saws Cutting Block of Marble Into Slabs.

rubbing beds. These consist of large steel disks which are rotated in a horizontal plane and on which is maintained a flow of water and sand. Several years ago it was the practice to make installations of group drive, five or six machines being driven through countershafting. Present-day practice has shown a tendency toward individual drive, squirrel-cage induction motors being belt-connected to each pair of rubbing beds.

Most of the polishing of flat surfaces is done on the type of machine shown in the accompanying illustration. It consists of a heavy two-part hinged bracket, linked together by two driving belts, at the end of which is a vertical shaft with a polishing disk at the lower end. The operator controls the movement of the disk over the surface by grasping a large iron loop. The disks, like the saws and rubbing beds, utilize water in quantities, but not sand, as they constitute in themselves the necessary abrasive. Carborundum is then used, followed by brown emery and fine hone, and lastly a felt-covered plate with a polishing putty. As these machines are a light and variable load they are group-driven.

Some quarries use circular saws for cutting and trimming marble slabs. The periphery of these saws has inserted diamond cutting tools, and very rapid cutting is possible, though they are not intended for the work done by gang saws and rubbing beds. The one illustrated is provided with a 25-horsepower motor for rotating the saw and a three-horsepower motor for driving the feeding mechanism.

The accompanying illustrations show typical applications of electric drive at the plant of the Vermont Marble Company at Proctor, Vt., the motors shown being of General Electric Company manufacture. A complete description of this installation appeared in the General Electric *Review* for November, 1915.

Diamond Saw Driven by a 25-Horsepower Motor with Three-Horsepower Motor for Feeding Mechanism.

Economy Shown by Electric Freight-Handling Apparatus Installed at Boston.

The New York, New Haven & Hartford Railroad Company recently installed in its main freight houses at Boston, Mass., two electric vehicles, which has resulted in a more systematic and economical handling of freight. These trucks are used to move goods from inbound sheds to outbound sheds in the terminal, and vice versa.

The railroad company is saved the cost of shunting cars backward and forward. It is probable that the New Haven will install trucks at other principal points on its lines.

At the North and South stations in Boston the use of electrically propelled baggage trucks is estimated to have resulted in a saving of 66 per cent in the total cost of handling baggage.

It is understood that the Cunard Steamship Company will put in electric stevedores at its Boston docks when the war is over. The company is now using them at its New York piers. Officials of the company say that in handling boxed goods six electric stevedores did the work of 24 hand trucks in a given time. The cost of a day's operation with the electrics was $21, while at current wages it would have cost $87.50 for the necessary number of longshoremen using hand trucks.

A plan has been put on foot at Boston to form a company for the handling of freight at steamship piers by means of a system of electric chassis with detachable bodies. A crane lifts a loaded body, places it on the chassis, and while being delivered to its destination, other bodies are being loaded to be hauled away by trucks, to a maximum distance of five miles. The Merchants & Miners Transportation Company is behind the plan.

A Variable Self and Mutual Inductor.

The Bureau of Standards, Department of Commerce, has just published a paper which describes a new form of instrument for varying that property of an electrical circuit (self inductance) which opposes any change in the strength of a current, just as the inertia of a heavy train of cars opposes any change in its speed. It consists of two sets of coils of insulated wire mounted in circular hard-rubber plates between which a similar plate carrying two coils is arranged to turn, thus varying the inductance. Diagrams and data are given from which instruments of this type may be designed to meet the requirements of a given use. Comparison is made of the new instrument and of older ones.

Copies of this report, Scientific Paper No. 290, will be ready for distribution in a few days and may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

Lexington Utilities Company Obtains New Franchise.

The Lexington Utilities Company, Lexington, Ky., has purchased from the city a new 20-year franchise, buying at the upset price of $10,000 without competition. The measure, effective on November 1, provided for a reduction of about 40 per cent in the service charges and for rate revision every four years. The maximum residential lighting rate is 9 cents per kilowatt-hour, 8.5 cents for commercial lighting and 8 cents for power, with a 10-per-cent discount on all bills for prompt payment and further discounts for large consumption. A new schedule for street lighting is being worked out.

Some Legal Aspects of Lightning Protection

Resume of Several Important Court Decisions Relative to the Liability of a Public Utility in the Matter of Protecting Its Lines With Lightning Arresters

By William E. Mooney

LIGHTNING arresters are such a common affair in the electrical industry that a short discussion of the proper kind to use is important. Mrs. A. E. Kitchens was a customer of the Columbus (Ga.) Railroad Company, which was engaged in furnishing and supplying electricity for lighting purposes. Its wires, used to conduct the current, were among the best known conductors of electricity in use. The wires from the street to Mrs. Kitchens's residence extended from a 40-foot pole that stood upon a sort of mound or hill about 90 feet from the house. A slight electric storm occurred, at which time Mrs. Kitchens was engaged in her usual household duties, and was standing about three feet from one of the electric lights in her residence, when lightning struck the pole outside and the resulting shock threw her to the floor and injured her. The court decided substantially that where an electric company maintains overhead wires from its plant to a residence of one of its patrons, for the purpose of supplying light to the house, the company is under a duty to employ such approved apparatus in general use as will be reasonably necessary to prevent injury to the house, or persons or property therein, arising from electricity which may be generated by a thunderstorm and strike the wires and be conducted thereby into the residence.—*Columbus Railroad Company vs. Kitchens,* 142 *Georgia,* 677.

The reasons for this decision are based upon rules fairly well settled. Those operating electric light systems for the transmission of electricity upon and over public highways owe to the public the duty of properly constructing and maintaining their respective wires and poles—they are bound to provide such safeguards against danger as are best known and most extensively used, and all necessary protection must be afforded to avoid casualties which may be reasonably expected.

Electric companies, to be sure, are not insurers against accidents, but they are bound to use reasonable care proportioned to the danger of injury. To determine whether proper care and diligence has been observed in the construction or maintenance of transmission wires and poles not only the physical structure of the wires and poles must be considered, but also the use to which they are to be put, the nature of the current to be transmitted, the position with relation to other lines, and its proximity to travelers.

Science and common experience show that suspended wires attract electricity in times of storms and may be highly dangerous to anyone brought in contact with them at such times. Every individual of mature age is presumed to know of the ordinary forces of nature, and to conduct himself so as to avert danger, and no one can invite injury and still act as an innocent victim.

This rule is again illustrated in the case of Escambia County Electric Light & Power Company vs. Sutherland, 61 Florida, 167, where Sutherland was killed by coming in contact with an electric wire in a mill in which he was employed. The electric company was held responsible because of failure to use proper equipment to prevent such an accident.

While the foregoing illustrations all pertain to personal injuries, yet the rule is the same concerning the destruction of property. In the case of Hanton vs. New Orleans & C. R. Light & Power Company, 124 Louisiana, 562, a fire occurred in a dwelling by reason of the electricity conveyed into it by wires. The fixtures had been in use for years, and even if they had been insufficient, the company being in that particular business, was obliged to inform itself fully as to what was needed on the premises.

An electric company has a duty not to anticipate every accident and injury that may occur, but only such as could reasonably and naturally have been anticipated by persons of ordinary prudence, in the light of surrounding circumstances. As stated before, an electric company is not an insurer against accident—it has a right to assume that the general public will treat its wires and equipment with due care and caution, realizing the potential danger. This rule is flexible so that it fits the surroundings, and the persons with which it has to deal. Accordingly, children are not to be supposed to have the wisdom and foresight of adults, and the rule thus makes it incumbent upon the company to anticipate accidents to children. This does not mean that every accident to a child might have been anticipated, but only such as should reasonably and naturally have been anticipated. Thus an electric company which maintained an uninsulated wire carrying a heavy current in a cut under a street below the level of the adjoining property, is not liable for injury to a boy who throws a wire over the charged one from the top of the adjoining bank. If, however, it had been customary for the boys of the neighborhood to indulge in games which involved communication across the cut and the company had notice, either actual or constructive, of this practice, then the company could be held liable.—*Kempf vs. Spokane & Inland Empire Railroad Company,* 144 *Pacific,* 77.

This rule may be again illustrated in the case of an electric company maintaining, some distance from the ground, an uninsulated wire carrying a heavy current of electricity over which boys threw a piece of wire which they found on the road. The company would not be liable for any injuries sustained by one of the boys.—*Green vs. West Penn Railways Company,* 246 *Pennsylvania,* 340.

John Geroski was a janitor of a hall fronting upon a public street, upon the roof of which was a flag pole. Electric light wires were strung upon poles along the side of the street in front of the hall, at a distance of about 12 feet from the building. A rope had always been used to raise the flag on the pole, but on the day of the accident Geroski attempted to remove the rope and replaced it with a piece of copper-plated wire. He attached an end of the wire to the rope and began to pull it up. When the wire reached the top of the pole, it became entangled in some way. Geroski tried to loosen it by pulling and shaking the wire and rope. While so engaged the small wire came in contact with the electric wires and Geroski was killed from the resulting shock. The court decided that the company could not have reasonably anticipated such an accident.—*Geroski vs. Allegheny County Light Company,* 247 *Pennsylvania,* 304.

Norfolk Committee Study Boston Lighting System.

A committee of the Norfolk (Va.) city government, appointed to study the lighting systems of various large cities, both with respect to street illumination and the lighting of homes and factories, visited Boston August 14, going later to Fall River, Syracuse, Washington, Baltimore and Richmond, Va.

HOW TO SELECT METALS FOR MAGNETS.

By Arthur E. Paige.

It is the purpose of this article to indicate some conditions and elements which determine or affect the magnetic quality of commercial iron and steel alloys, and to facilitate the selection thereof by those without special knowledge of electrical science.

Magnetization of ferromagnetic metal affects many of its physical properties, for instance, its elasticity, its electric conductivity, its thermo-electric power, and its dimensions. Conversely, the magnetic properties of such metal are affected by changes in its physical properties, for instance, by mechanical stress and changes of temperature. For instance, the length of an iron or soft-steel bar is increased by magnetization, proportionally to the square of the intensity of magnetization up to the saturation point of the metal, but, if the magnetizing force is increased beyond that point the bar gradually shrinks, until it becomes shorter than when unmagnetized. Such elongation generally reaches the maximum under a magnetizing field of 50 to 120 C. G. S. units, vanishes under a field of 200 to 400 units, and retraction is effected under higher fields and apparently reaches its limit in fields where H equals 1,000 to 1,100 units. Other paramagnetic metals are variously contracted or expanded when subjected to magnetizing forces; the behavior of cobalt being opposite to the iron or soft steel above contemplated. Hardened steel changes in form in a manner similar to that of soft iron or steel above noted, except that it regains its original length when the magnetizing field reaches a *critical value* depending upon the hardness of the metal, which value *diminishes* as the hardness increases up to the point where the metal is colored yellow by its surface oxide. However, above that point the critical value *increases* until it reaches its maximum height with the hardest steel. Plain carbon steel which has been hardened by sudden cooling and then tempered yellow as above contemplated manifests a smaller critical value of the magnetizing field than steel which is either softer or harder, such value being in fact so small that such metal contracts, even under weak magnetizing fields, without undergoing any appreciable preliminary elongation.

All such changes require time and are accompanied by modifications in the form of energy,—heat appears as magnetization vanishes, and vice versa. Therefore, there is apparent lag in magnetization and demagnetization in metal in sequence to changes in the inducing field and, loss of energy; and both vary with the composition and state of the metal. Such lag is termed *hysteresis*, and such loss *hysteretic*, and both should be considered in selecting metals for magnets, particularly for temporary magnets subjected to rapid reversals or other variations in magnetic fields, as in electric generators and motors.

The apparent relation between the amount of energy dissipated in subjecting iron or steel to a magnetic cycle, (i. e., a double reversal) and the maximum amount of induction manifested in the cycle, may be simply expressed as $W=\eta B^{1.6}$ where W=the work in ergs upon a cubic centimeter of the metal, B =the maximum induction, and η is a hysteretic constant, varying, in soft iron and steel, from 0.001 to 0.04 and approximating 0.002. This formula is applicable to Swedish iron up to B= 18,000 gausses; to tungsten-steel and cast cobalt up to B=8,000, and to nickel and annealed cobalt up to B=3,000. Constants applicable to various commercial metals are as follows:

Best annealed Swedish iron, thin sheets	0.001
Best annealed Swedish iron wire	0.002
Ordinary sheet iron	0.004
Best annealed cast steel	0.008
Best annealed machine steel	0.009
Ordinary cast steel	0.012
Ordinary cast iron	0.016
Ordinary hardened cast steel	0.025

The standard expression of *hysteretic loss* is in watts per pound of the metal, with induction 2,500, at a frequency of 100 double reversals or cycles per second, but, some manufacturers express it in horsepowers per ton, of their metal, or in ergs per cubic centimeter per cycle; it is to be noted that as one horsepower=746 watts, and one ton=2,240 pounds, the factor for reducing horsepower per ton to watts per pound, is simply ⅓. The loss for any induction B within the range of said formula, may be converted to the standard B=2,500, by dividing it by $B^{1.6}/2{,}500^{1.6}$.

It is usual to select for electromagnets the best Swedish charcoal-iron, and such metal (of the best grade now obtainable in the market) averages 0.03 per cent of carbon and manifests B=16,800 for H=45, residual B=9,770, permeability μ= 1,625 for H=8, and a coercive force of but (reverse) H=1.66 is required to eliminate said residual B. Such metal is subject to hysteretic loss amounting to 0.382 per pound for maximum B=9,000 at 100 cycles. Of course, for temporary magnets, such Swedish metal is far superior to the average cast iron of American manufacture, which averages μ=62 for H=40. However, it is far inferior to silicon-iron containing Fe, 97.3; C, 0.2 and Si, 2.5, which, in fields up to H=10, not only manifests greater permeability than the best Swedish metal, but, for the same maximum B and frequency, suffers hysteretic loss of but 0.254 watt per pound.

Whether metal is being selected for temporary or permanent magnets, it should be as free from manganese as possible, for that element suppresses the magnetic quality of any ferromagnetic in which it is included. For instance, the addition of 12.36 per cent of manganese to a high-grade iron of excellent magnetic quality was found to reduce its permeability to 1.27 for H=8.

Although it is usual to select, for permanent magnets, plain high-carbon steel, hardened and tempered as above described, ordinary commercial chrome-steel is better for that purpose, in that it manifests a coercive force of 9 when annealed and may manifest as much as 38 when oil-hardened. However, such coercive force is far exceeded by other alloy-steels, of more costly composition, as indicated by the following table, in which several are arranged in the order of their coercive force:

	Element	Per Cent	B for H=45	B Residual	μ for H=8	Coercive Force
1	Molybdenum	4.0	.....	.....	.....	85
2	Molybdenum	3.5	.....	.....	.....	80
3	Tungsten	2.35	.....	.....	.....	70.7
4	Tungsten	3.44	.....	.....	.....	64.5
5	Nickel	19.64	7770	4770	90	20.0
6	Tungsten	7.5	15230	13280	500	9.02
7	Nickel	3.82	16190	9320	1375	2.76
8	Carbon	0.03	16800	9770	1625	1.66
9	Nickel	31.4	4460	1720	357	0.5
10	Manganese	12.36	.....	.....	1.27	.....

Specimens Nos. 8 and 10 are included in said table for comparison with the other alloys; No. 8 being a sample of Swedish charcoal-iron and No. 10 being the iron to which manganese was added as above described. It may be observed, with reference to said table, that the alloy containing but 2.35 per cent of tungsten has more than seven times the amount of coercive force of the alloy containing 7.5 of tungsten, and, consequently, is accordingly superior for permanent magnets. However, the best alloy for that use, so far discovered, contains four per cent of molybdenum. Of course, such alloys are costly, and, for many uses, permanent magnets of satisfactory coercive force may be formed of ordinary cast iron which has been chilled by the ordinary processes for surface hardening such metal. Such processes, when effective for that purpose, are found to have changed the cast iron so that there is more combined carbon (cementite, Fe_3C) at the surface than is present in the other portions of the metal. Such processes are most effective when the metal is quenched in an acid solution maintained below the freezing point of water. In this connection, it may be noted that an alloy containing 0.25 nickel and normally manifesting permeability 1.4 for any value of H; when cooled below the freezing point of water, becomes as magnetic as the average cast iron and thereafter retains its magnetic properties until heated to 580 degrees Centigrade, at which temperature it loses its susceptibility to magnetization, and therefore remains in that state, until it is again frozen. From this and similar phenomena, it may be reasonably presumed that all metals may reach the magnetizable state, at some temperature.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Nashville Company Finds Renting Fans Good Business.

The Nashville Railway & Light Company has been alleviating the discomforts of the summer by the rental of 2,400 electric fans to its customers. This is the twelfth year in which the company has followed this plan and the number of fans required has shown a great gain each season. It is no longer necessary for the company to advertise the scheme, as there is always a long list of applicants early in the summer. However, notices of the plan are sent out with the monthly bills. The majority of those using this scheme to secure summer comfort place them in residences, although one department store takes nearly 250 fans, apparently finding this more convenient than purchasing them.

All contracts are made on a three-months minimum basis. The prices charged are as follows: 12-inch alternating-current fan, $1.11 per month; 16-inch alternating-current, $1.66; 12-inch direct-current, $1.66; 16-inch direct-current, $2.22. Where a line is run into the house for the fan only, a flat rate for current is charged, if desired, the 12-inch alternating-current fan costing $3.33 and the 16-inch $5 per month. A combined charge of rental and current is $4 and $6 respectively. These rates are subject to the usual 10-per-cent discount for prompt payment. On the back of the application cards, which are sent out at the beginning of the season to all customers, the cost for operating these fans on light meter is given as less than one cent an hour for 12-inch fans and about one cent for 16-inch fans.

The rates charged provide the company with a small profit from the rental, with enough margin to act as a sort of insurance, while the aggregate of meter receipts is a large item.

Mammoth Sign for Minneapolis.

A new electric sign is being erected in Minneapolis by the Washburn-Crosby Company. It will cover the eight buildings of the company's flour mills, will be 400 feet in length and the lowest part will be 150 feet from the ground. Construction is in three sections. The first section, which will measure 47 by 60 feet, will bear the word "Eventually," and will be located on the top of the tallest mill. The "E" of this word is 17 feet high, and the tail of the "Y" measures 47 feet from tip to tip. Six hundred and twenty-five 25-watt lamps will be used to illuminate the one word. The other two sections of the sign will each measure 17 by 200 feet. Electric energy for the illumination will be furnished by the Minneapolis General Electric Company.

Denver Street-Lighting Contract Under Consideration.

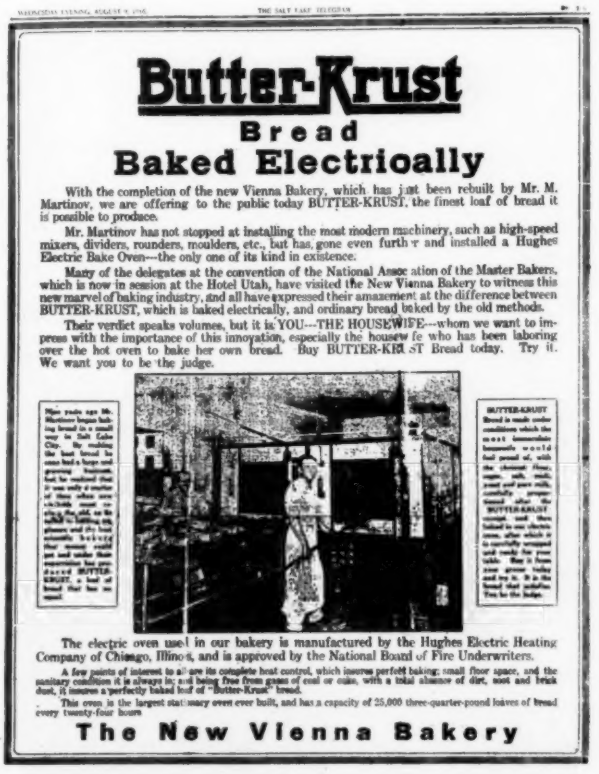
Mayor Speer, of Denver, Colo., is at the present time considering a new contract between Denver and the Denver Gas & Electric Light Company embracing the rates, service and new conditions for city lighting. The old contract was made ten years ago and expired last June. Rates and service for the private consumer are not involved.

SALT LAKE WHOLESALE BAKER INSTALLS ELECTRIC BAKE OVEN.

Noteworthy Installation Demonstrates Practicability of Large Electric Ovens.

So far as is known the first brand of bread to be put on the market which will be extensively advertised as being baked electrically has made its appearance in Salt Lake City. The New Vienna Baking Company of that city announced this new product during the week of August 7 to 12 while the convention of the Association of Master Bakers was in session in that city. "Butter-Krust," the trade name adopted, is baked exclusively in a mammoth Hughes electric bake oven installed by this progressive baking company. This company does an exclusive wholesale business, its entire product being sold through retail dealers.

The announcement made by Mr. Martinov, manager of the baking company, during the convention, will do much to stimulate interest in electric bake ovens all over the



Butter-Krust

Bread

Baked Electrioally

With the completion of the new Vienna Bakery, which has just been rebuilt by Mr. M. Martinov, we are offering to the public today BUTTER-KRUST, the finest loaf of bread it is possible to produce.

Mr. Martinov has not stopped at installing the most modern machinery, such as high-speed mixers, dividers, rounders, moulders, etc., but has gone even further and installed a Hughes Electric Bake Oven---the only one of its kind in existence.

Many of the delegates at the convention of the National Association of the Master Bakers, which is now in session at the Hotel Utah, have visited the New Vienna Bakery to witness this new marvel of baking industry, and all have expressed their amazement at the difference between BUTTER-KRUST, which is baked electrically, and ordinary bread baked by the old methods.

Their verdict speaks volumes, but it is YOU---THE HOUSEWIFE---whom we want to impress with the importance of this innovation, especially the housewife who has been laboring over the hot oven to bake her own bread. Buy BUTTER-KRUST Bread today. Try it. We want you to be the judge.

The electric oven used in our bakery is manufactured by the Hughes Electric Heating Company of Chicago, Illinois, and is approved by the National Board of Fire Underwriters.

A few points of interest to all are its complete heat control, which insures perfect baking; small floor space, and the sanitary condition it is always in; not being free from gases of coal or coke, with a total absence of dirt, soot and brick dust, it insures a perfectly baked loaf of "Butter-Krust" bread.

This oven is the largest stationary oven ever built, and has a capacity of 25,000 three-quarter-pound loaves of bread every twenty-four hours

The New Vienna Bakery

Full-Page Newspaper Advertisement Announcing Installation of Electric Oven.

United States. A full-page advertisements in the Salt Lake City newspapers while the Bakers' convention was in session attracted much attention and practically every baker in attendance at one time or another visited this new installation. Mr. Martinov has a thoroughly modern bakery throughout including individually motor-driven mixers, di-

viders, rounders and electrically heated wrapping and sealing machines. While his "Butter-Krust" bread was first announced during the convention week it sprang into instant popularity. The afternoon that the writer visited his bakery they were completely sold out of it and it was difficult to find even a sample. While the rules of the association do not permit formal discussion on the floor of the convention of new appliances and installations this installation was the topic of an immense amount of informal discussion wherever groups were assembled.

This oven is said to be the largest electric oven yet installed. The main body is four feet high, ten feet wide and twelve feet deep. It rests on an angle-iron frame 27 inches high. It is divided into four chambers each 56 inches by 34 inches by 16 inches high, which provides a baking surface of 208 square feet. The oven has a capacity of 836 twelve-ounce loaves or 456 25-ounce loaves of bread. The oven is divided in the center by a partition with two baking compartments on each side, one above the other. All compartments have a 1.75-inch tile floor. The customary steam connection is provided for each. Each half of the oven has three heating units. One in the top of the upper compartment; one in the top of the lower compartment; and one directly under the floor of the bottom compartment. With this arrangement, heat is provided for the top and bottom of each baking chamber. Each compartment has a mercury thermometer and inside lights.

The heating units are made up of resistance wire wound on insulated rods. These rods are mounted in an angle-iron frame which may be slipped in and out of the oven for inspection and repairs. Each unit is divided into three sections and each section has three heats controlled by three-heat switches which are located near the center of the oven in front and within easy reach of the operator. This arrangement gives great flexibility and enables the baker to produce a uniform temperature throughout the entire baking surface of the oven. The doors through which the oven is filled are of the balanced type and are easily opened.

The oven is wired to receive 220-volt two-phase service. It has a maximum demand of 75 kilowatts and averages 48 per cent of its maximum demand on 16 hours baking per day and 55 per cent on eight hours baking per day. It requires 45 minutes to load the oven, bake the bread and take it out, using three-quarter pound loaves. On this schedule 25,000 three-quarter pound loaves could be baked in 24 hours' continuous baking.

The product is admitted by all bakers to be superior to that produced by the old-style ovens.

One great advantage of the electric heat lies in the fact that it is possible to maintain practically a uniform temperature in the oven through the entire period of baking, while with the brick oven the temperature gradually reduces and the time for baking is extended, making it difficult to produce a uniform product.

A talk with the manager and head baker brings out the fact that they are very enthusiastic over electric baking. While they state that the bare cost for electricity is some higher than the cost of coal, that when one considers the many advantages of the electric oven, not the least of which is the entire absence of dirt, dust and smoke which inevitably go with the old brick oven, and the saving in space, the higher cost for fuel is more than offset.

Electric Oven in Vienna Bakery, Salt Lake City.

1,000 GAS ARCS REPLACED BY ELECTRIC LAMPS IN TWO MONTHS.

Union Gas & Electric Company Adopts Pratice of Giving Free Electric Units in Exchange for Gas Arcs in Cincinnati.

By W. A. Wadsworth.

All of us directly or indirectly responsible for the growth of a central-station company's business feel that the gas arc is more or less of an enemy; considerably more of an enemy if natural gas is available at 30 or 40 cents per thousand cubic feet. We look with envy at the long-hour business that the gas companies enjoy, and compute over and over again on paper and in our minds the revenue that would accrue to us if only electric units were causing our little old meter to keep on the job instead of having a vacation about 22 hours out of every 24. We feel all the more sorrowful over the situation if our service is installed, or at least is available, as is generally the case. In the majority of cases we have the account already on our books and are getting a small amount of revenue for cellar, office, back room or other short-hour lights, and we sigh again as we think of the difference between a minimum or small monthly bill and one several times its size which would result from the replacing of the dirty, hot, cumbersome and antiquated gas arc by a modern, artistic and efficient unit containing a gas-filled lamp; and the customer would be getting his money's worth too.

We know from experience that once the change is made it would take more than the difference in the monthly bills to cause a change again to the old gas arc. Like everything else in this world that appears wrong to us the question arises, "What are we going to do about it?" The company with which the writer is connected sized up the situation about as follows.

The gas arc had made considerable strides in Cincinnati, O., and was in existence in very large numbers. The central station was anxious to cover every field for business where there was a reasonable opportunity to increase the number of its customers and its revenue. It appeared that the average revenue from the residence customer was about $18 per year. The cost of securing a residence customer where wiring order had to be obtained was approximately $5.00, this, of course, not including the cost to serve made up of service, meter, transformer, line, station equipment and everything back to a part of the president's salary. The net profit, if any, from the residence customer is very small, this point being one very much debated and still debatable. In any event, at the average rate an equal amount of revenue from the commercial customer would result in larger net profit than the same amount of revenue derived from the ordinary residence.

From time to time a reasonable amount of effort by salesmen of the ordinary type had been put forth to secure business from commercial customers which would mean the displacing of gas arcs. Various schemes have been tried, considerable progress made, but we did not seem to get at the real heart of the situation. It was quite apparent that the customer could not easily be induced to make the necessary expenditure to purchase these units plus the cost of wiring necessary to properly install them.

The Union Gas & Electric Company believed it would be feasible to furnish suitable units free. With this in view the cost was obtained of four types of lighting units consisting of one semi-indirect unit, two direct units, and one outdoor unit, all equipped with 300-watt lamps. These cost complete, including lamp and hung with pull-chain switch, not to exceed $5.00. The company believed that it could afford to give the customer one of these units provided it could be assured of the revenue which it would produce if continued in operation for at least one year. With this in mind the proposition contained in the following form, which constituted a contract, was announced.

1 From a paper presented at the recent convention of the Ohio Electric Light Association.

APPLIANCE CONTRACT.

Date.....19....

The undersigned hereby requests The Gas and Electric Appliance Co. to furnish.....

.....

Equipped with.....

.....

At premises.....

It being understood and agreed that all appliances and attachments furnished under this agreement, are and shall remain the property of The Gas and Electric Appliance Co. until the expiration of twelve (12) months from date of installation, when they shall become the property of the Consumer, provided, however, that the consumer shall give to The Gas and Electric Appliance Co. at the time the electric units are installed, permission to remove and retain one (1) gas arc for each electric unit, and also provided that the electric units are used during the twelve (12) months they remain the property of The Gas and Electric Appliance Co. and are not replaced with any other units.

The Gas and Electric Appliance Co. will maintain these units and furnish free renewals of lamps during the period the units remain its property. The consumer, however, shall use reasonable care to protect the units while in his possession, and shall pay for renewals or broken parts required due to accident or negligence on the part of the consumer.

The consumer shall not sell or remove these units or any parts of the same without the written consent of The Gas and Electric Appliance Co.

The revenue from one of these units was estimated as follows: On the basis of 300 watts burning four hours per day, 300 days per year, the annual consumption would amount to 360 kilowatt-hours. This at five cents would amount to $18 per year, or $60 per kilowatt connected. Under the above mentioned arrangement the estimated cost of these units for 12 months was as follows:

Unit complete and hung	$ 5.00
Selling expense	2.00
Renewal and maintenance	3.00
Total	$10.00

It is pretty general practice to make an investment to obtain electric business equivalent to the revenue received from one to two years. On this basis the above proposition easily comes within the limit of average practice. As a matter of fact the proposition is better than the above figures indicate, because the cost of the unit is subject to a credit equivalent to the amount received from the gas arc, which will average about $1.50. Besides this the tendency would be for the customer to continue to use these or other electric units after he has become accustomed to the advantages of electric service. In order to go back to gas service he must necessarily equip his place with new units at considerable expense.

The result of the two months this campaign has been in effect is the replacing of slightly over 1,000 gas arcs and a considerable number of gas burners, the proposition having recently been modified to the extent that one electric unit is given in exchange for four gas burners, or a credit given of $1.25 for each gas burner replaced.

An important feature of this campaign is that 120 stores that were using very little or no electric service have wired the principal part of their stores and are now using electric service exclusively, or at least it has become the principal method of illumination.

On the assumption that 5,000 gas arcs could be replaced the result on paper would be as follows:

Cost of 5,000 units installed and maintained for one year	$50,000
Revenue for one year	90,000
Kilowatts connected	1,500

Add to this the "intangible assets" and the proposition is one that offers food for thought. In the case of our company it has not only done that but has proven a very decisive blow to the gas arc and made a very attractive increase in commercial lighting revenue.

Houston Company to Pump City Water.

The Houston Lighting & Power Company has just closed a contract with the city of Houston for municipal pumping and sewerage-disposal plants calling for a minimum guarantee of $25,685.85, with a minimum annual consumption of 2,343,600 kilowatt-hours. By the terms of the contract the city is compelled to relieve the plant of 20 per cent of its load during the company's peak period, which insures an excellent return from the business.

Oklahoma City's White Way Celebration Big Success.

Oklahoma City's new "White Way" was celebrated by a parade and a street dance in which more than 30,000 residents participated. The Governor of the State was the first one to purchase a ticket for the dance, the receipts from which will be used for hot weather relief of children. Mayor Overholser's son pressed the button which turned on the illumination of the modern White Way system consisting of 84 single-light standards, each unit being one of the new 1,400-candlepower luminous arcs. The turning on of the lights was the signal for starting the parade which included employees in all city departments, merchants, automobiles carrying citizens and a large number of attractive floats.

The White Way, which covers the three busiest blocks on Main Street is the nucleus for a larger system for which plans are now being made. The White Way was first suggested and promoted by W. P. Jones, general contracting agent of the Oklahoma Gas & Electric Company. The installation was paid for by individual merchants and the city pays for the current used. All of the newspapers cooperated in making the celebration a success and printed many columns of history of the city's lighting system and several editorials pointing out the importance and value of modern illumination. Pages of advertising were run by merchants, calling attention to the new lighting system and inviting the public to attend the celebration. An advertisement by the Oklahoma Gas & Electric Company demonstrated the value of the White Way from the standpoint of its effect upon visitors, as follows:

"The stranger within our gates may be only a transient—but the impression he takes away with him—lives to bring or scare away other visitors.

"A city's business district is a show place or a thing to be avoided accordingly as it is lighted; nine-tenths of the transients never venture beyond the business district—and not far in that at night if the streets are not attractively and invitingly illuminated.

"Population—the measure of a city's growth—increases as the opportunities for agriculture, manufacturing and commercial development are utilized. These need, constantly, new people and new money.

"New people and new money seek locations in attractive, growing communities. That is the law which has built Oklahoma City and made it a good place in which to work and live.

"Our business district has always been a source of pride—the new Main Street "White Way" will add to that pride.

"Legion strangers will bear with them a message of Oklahoma City's progressive merchants, attractive illumination and evident prosperity. Many will return to stay—or encourage others to visit and then to stay."

Minimum Monthly Charge Promotes Appliance Use.

The Public Service Electric Company, of New Jersey, has a $1 monthly minimum charge for lighting service, which is considered a "minimum charge for line service and equipment."

This charge, it is found, tends to encourage the use of electrical appliances, particularly during the summer, when a small householder's bill for lighting at the primary rate of 10 cents per kilowatt-hour would not reach an average of $1. This minimum having to be paid, the customer sees that it is to his advantage to utilize the energy represented, and the usual result is, that the use of electric irons and other devices, most of them calling for day supply, makes for bills considerably in excess of $1, the difference representing a fair profit to the company.

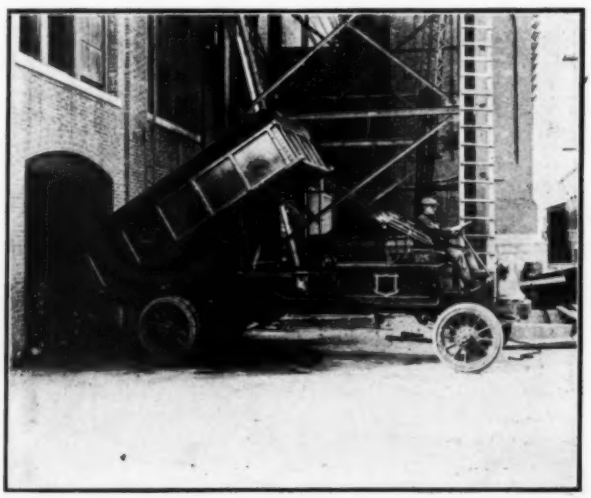
Texas Company Sells 2,400 Fans in Campaign.

As reported in our issue of August 5, 1916, the Texas Power & Light Company recently conducted an electric-fan campaign in all of its properties. A 12-inch green-enameled fan was featured for $10.25, on the basis of $2.25 cash and $2.00 per month for four months. A coupon worth $1.00 towards the purchase of a $3.50 electric iron was given as a premium to customers paying cash. It was erroneously stated in our issue of August 5 that the campaign resulted in 1913 fan sales. As a matter of fact 2,400 fans were sold during the period of the campaign and since that time many additional sales of other types of fans have been made.

Electrical Trucks for Industrial Service at Boston.

The use of electric trucks for various types of industrial service in New England is steadily increasing. The accompanying illustrations indicate two widely diverse uses to which these vehicles are put. One of the trucks is used by a central-station company for hauling its coal from a wharf to the generating station. This is a G. M. C. vehicle and is equipped with a 60-cell Edison A-10 battery. The other truck is of 2-ton capacity, with 44-cell Philadelphia 21-plate W. T. X. storage battery. It is used by a Boston suburban plumber to haul pipe and other fittings employed in his business, and to this end the chassis is equipped with a long, covered body.

Plumbers' Supply Vehicle.



Electric in Central-Station Service.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

ESTIMATING FOR THE SMALL HOUSE-WIRING JOB.

By F. E. Andrews.

There seem to be a lack of available data and information on the subject of estimating the small house-wiring job, such as is frequently met with by the electrical contractor in the average small town. Recognizing this deficiency, the writer has gathered data from a number of actual jobs, representing usual and average conditions. Only knob-and-tube work, concealed of course, is considered. These data have been tabulated and put into shape to make them applicable to the requirements of the average estimate.

The time and material used on each job from which the data have been taken have been reduced to the quantity required per outlet. The work has been separated into three general divisions, as follows:

Class A—New houses, wired when built, when all places for running the wires were readily accessible. This division includes both one and two-story houses, as there seems to be no material difference in the data from these two.

Class B—One-story cottages, having the wiring done in the attic above the whole house.

Class C—Two-story houses, requiring that the floors be taken up for the wiring of the lower story.

While there does not appear to be a great difference in the data from these three divisions, it was, nevertheless, on account of the distinction in the method of doing the work, deemed advisable to make the division.

The tables herewith give the data for each of the three classes of work. By an outlet is meant each place, for either a light or a switch, where the wires are brought out. The wiring for the meter and service entrance is counted as one outlet, because in all of these cases no special installation, such as conduit, was used.

The outlets are divided into two kinds, ceiling outlets, requiring only the ordinary amount of loom, and wall or other outlets, requiring an unusual amount. A deduction is made from the total amount of loom used on the job, making allowance for the extra amount used by the second over that which would have been used had all of the outlets been of the first kind. This reduction cannot, of course, be absolutely accurate, and has generally been made about nine feet per outlet. Probably about eleven or twelve feet are generally used in all on this kind of an outlet, with the height of ceiling generally met with on the jobs considered, and the deduction reduces all outlets to the same basis, for convenience in estimating. It is obvious that this deduction is unnecessary for Class A houses, as all wires inside of partitions are knobbed, making extra loom unnecessary. For two-story or Class C houses, a deduction must also be made for the loom used to run between the floor and ceiling of the second story. These deductions are shown in the tables.

For each of the three classes, the time and material required per outlet have been averaged on the last line.

The time on each of these jobs includes a reasonable amount for the installation of switches, drops, receptacles, or similar fixtures requiring a minimum amount of time. This enables the cost of the job in most cases to be estimated simply by the addition of the material cost of these appurtenances to the wiring cost estimated in accordance with the plan given in this article.

CLASS A.—HOUSES WIRED WHILE UNDER CONSTRUCTION.

	Number of Outlets.	Number of Wall and Other Outlet Requiring Extra Loom.	Total Feet Loom Used.	Feet Loom Deducted for Wall and Other Outlets.	Feet Loom Deducted to Run Between Floors, and Other Extras.	Feet Loom Used, After Making Deductions.	Feet Wire Used.	Hours Time.	Knobs Used.	Tubes Used.
Job I. Totals	18	....	34	....	....	34	500	25	139	100
T. & M. per outlet	....	....	....	....	....	1.9	28	1.4	8	5
Job II. Totals	22	....	33	....	....	33	643	32	184	150
T. & M. per outlet	....	....	....	....	....	1.5	29	1.5	8	7
Job III. Totals	16	....	20	....	....	20	575	22.5	171	160
T. & M. per outlet	....	....	....	....	....	1.3	36	1.4	11	10
Job IV. Totals	17	....	28	....	....	28	471	20	90	125
T. & M. per outlet	....	....	....	....	....	1.7	28	1.2	5	8
Job V. Totals	22	....	36.5	....	....	36.5	510	20.5	140	159
T. & M. per outlet	....	....	....	....	....	1.7	23	1.3	6	7
Average time and material per outlet	....	....	....	....	....	1.6	29	1.4	8	7

CLASS B.—ONE-STORY COTTAGES, WIRING IN ATTICS.

	Number of Outlets.	Number of Wall and Other Outlets Requiring Extra Loom.	Total Feet Loom Used.	Feet Loom Deducted for Wall and Other Outlets.	Feet Loom Deducted to Run Between Floors, and Other Extras.	Feet Loom Used, After Making Deductions.	Feet Wire Used.	Hours Time.	Knobs Used.	Tubes Used.
Job VI. Totals	10	5	88	45	....	43	350	16	80	60
T. & M. per outlet	....	....	....	....	....	4.3	35	1.6	8	6
Job VII. Totals	18	8	110	72	....	38	550	23.5	100	80
T. & M. per outlet	....	....	....	....	....	2.1	30	1.3	5	4
Job VIII. Totals	8	0	37	....	....	37	250	11	38	40
T. & M. per outlet	....	....	....	....	....	4.6	31	1.4	5	5
Job IX. Totals	5	0	20	....	....	20	215	6	24	50
T. & M. per outlet	....	....	....	....	....	4	43	1.2	5	11
Job X. Totals	8	2	39	18	....	21	195	8.5	40	22
T. & M. per outlet	....	....	....	....	....	2.6	24	1.1	5	3
Job XI. Totals	5	0	12	....	....	12	120	7	18	45
T. & M. per outlet	....	....	....	....	....	2.4	24	1.4	4	9
Job XII. Totals	9	2	60	37	....	23	297	10	59	13
T. & M. per outlet	....	....	....	....	....	2.6	33	1.1	6	2
Job XIII. Totals	13	6	84	54	....	30	375	19	60	52
T. & M. per outlet	....	....	....	....	....	2.3	29	1.5	5	4
Average time and material per outlet	....	....	....	....	....	3.1	31	1.3	5.4	5.5

CLASS C.—TWO-STORY HOUSES.

	Number of Outlets.	Number of Wall and Other Outlets Requiring Extra Loom.	Total Feet Loom Used.	Feet Loom Deducted for Wall and Other Outlets.	Feet Loom Deducted to Run Between Floors and Other Extras.	Feet Loom Used, After Making Deductions.	Feet Wire Used.	Hours Time.	Knobs Used.	Tubes Used.
Job XIV. Totals	17	7	118	63	....	55	453	27	83	112
T. & M. per outlet	....	....	....	....	....	3.2	27	1.6	5	7
Job XV. Totals	25	8	304	72	44	188	900	40	138	260
T. & M. per outlet	....	....	....	....	....	7.5	36	1.6	6	10
Job XVI. Totals	21	7	210	63	45	102	730	36	100	155
T. & M. per outlet	....	....	....	....	....	4.9	35	1.7	5	8
Job XVII. Totals	19	5	152	45	20	87	815	30	105	57
T. & M. per outlet	....	....	....	....	....	4.5	42	1.6	5	3
Average time and material per outlet	....	....	....	....	....	4.9	35	1.6	5	7

To show how these data may be utilized, an example of its application to an estimate is given. It is desired to estimate the time and material required to wire a two-story house of twenty outlets, six of these being wall outlets, including one set of three-way switches. One of the ceiling outlets is inaccessible, so that it will be necessary to fish that in under a roof for a distance of six feet. As the job does not promise to be so much different from the average, we will use the average data from Class C.

Wire required for 20 outlets at 35 feet each will be 700 feet. Loom required for 20 outlets at 4.9 feet each will be 98 feet.

Extra loom required over above, for 7 outlets fished, at 9 feet each, will be 63 feet.

Loom for two main lines, and two lines for three-way switch, running between the floor and ceiling of second story, will be 45 feet.

Total loom required will be 206 feet.

Time required at 1.6 hours per outlet will be 32 hours.

Knobs required will be 100.

Tubes required will be 140.

If no fixtures are used requiring an extra amount of time to hang, the material cost of the switches, drops, fixtures, etc., can be added to the cost of the above time and material, to arrive at the cost of the job.

This method of making an estimate must, of course, be tempered with judgment as to the points wherein the job under consideration might be different from those from which the data have been taken.

This article is not intended so much to give actual data for estimating as to show a method by which the contractor can gather and put into shape data for himself from his own jobs. It is only in this way that the individual contractor can be sure of making his estimates upon a correct basis. In other words, to make these ideas of greatest value to himself, the contractor must be thoroughly familiar with them from his own experience.

Insufficiency of Outlets Still Too Common.

In many houses and apartments, even those of the better and modern type, an insufficiency of outlets usually prevails, preventing occupants using and enjoying electrical appliances to the full extent otherwise possible, says the *N. E. L. A. Bulletin.*

In many well furnished, cosy homes, where the liberal use of artistic lamps could ideally be employed, and where the cost of current is not the determining factor, the housewife is ofttimes denied the comfort, convenience and beautiful lighting effects because of lack of outlets. The manufacturers suffer because more lamps would be sold if there did not exist this deficiency, and the central station's revenue is not extended as would otherwise be possible.

Take, for example, the flatiron. Some kitchens have but one outlet from which by day the lamp is removed to provide a receptacle for the iron. Night approaches. If a two-way outlet is not in use, the iron must be removed, unless some other form of illuminant is available (and the electric should be used), the lamp returned to the socket, and if it is desirable to continue ironing (work not always regulated by natural light) some other means than electric ironing must be used. Therefore, instead of current being employed for both lighting and ironing, a lesser amount is ofttimes used, and if this condition should prevail in many kitchens it would have an appreciable effect on central-station loads.

Outlets for any wired homes should be installed to permit the fullest possible use of current. No appliances should remain idle on account of insufficiency of outlets.

Progressive architects and builders should appreciate the advantages of having their houses and apartments properly wired. It will be apparent that fully wired buildings find a ready market, especially if the advantages are brought to the attention of the renting public. Perhaps it would be desirable to concentrate on one or a few houses or apartments in a community. After they had been sufficiently equipped with outlets, it would be an easier task to raise the standard generally by such examples.

Every kitchen equipped with a single outlet should be provided with an adapter or two-way outlet, so that both lighting and ironing could be conducted simultaneously, which would prove not only an appreciative convenience to the housewife and eliminate undue handling of illuminants, but would, furthermore, involve the use of more current by satisfied consumers.

Raising a Big Pole Without Difficulty.

The accompanying illustration shows the method of handling 55-foot creosoted poles on the Jenkins-Commerce 60,000-volt line now under construction by the Texas Power & Light Company. The poles are erected with cross arms and insulators already attached and by means of the gin wagon and pole shown can be erected quickly and safely.

Method of Raising 55-Foot Poles in Texas.

The International System of Electric and Magnetic Units.

All electrical measurements are based on certain standards kept at the National Bureau of Standards. These standards represent the units, such as the volt and ampere, in terms of which measurements are expressed. A number of different systems of electric and magnetic units have been proposed from time to time. These systems have been put forward as having noteworthy advantages in a theoretical way over the units which are ordinarily used. A careful study has shown that the advantages of the proposed systems are not such as to justify a general change of units. In fact, the ordinary units are in many ways superior to those proposed.

Polyphase Motor Windings—IV.

By Justin Lebovici

In this installment polyphase windings of the open type are taken up, and in the next installment numerical examples are worked out and illustrated for the various cases. The consideration of closed two-layer windings was given in the first three installments. In future installments single-layer windings and windings for two speeds will be described and special attention given to the mechanical design of the windings and insulation.

Open Windings.

Classification.—It has been shown that the closed lap and wave windings can be represented by equivalent ring windings having circles as potential diagrams.

Fig. 36 shows diagrammatically a two-pole closed-ring armature placed in a two-pole field and the potential diagram for

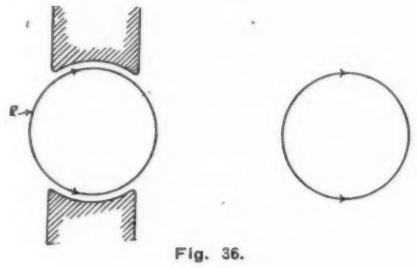


Fig. 36.

same. The arrows indicate that the direction of resulting current in the top and bottom half of the winding oppose each other at any instant.

Quarter-Phase Systems.—Assume the closed winding R in Fig. 36 split open at four points as shown in Fig. 37. For a distributed winding the electromotive force (or counter electromotive forces for the case of the motor) generated in each of the sections I, II, III, IV, of Fig. 37, is given by the chord I, II, III, IV in the right of the figure. Fig. 37 shows the dis-

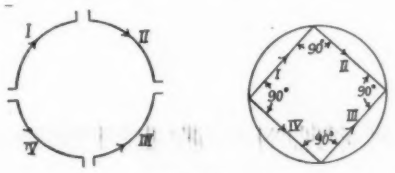


Fig. 37.

placement of the four winding sections in space while the winding potential diagram shows the corresponding time-phase displacement. The electromotive forces in sections I and II, for example, are in time quadrature, while the electromotive forces in sections I and III are in time phase.

Two-Phase, Four-Wire System.—The sections I and III in Fig. 37 can be interconnected as shown in Fig. 38, which gives also the winding potential diagram. Sections I and III form one phase, while sections IV and II form the other phase. The voltage and current in one phase we will designate by the index p. The line voltage and current we will distinguish by the index l. In Fig. 38 we have $E_p=E_l$ and $I_p=I_l$.

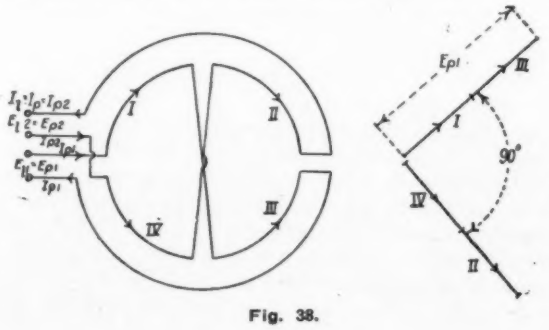


Fig. 38.

The electromotive forces and currents in the two phases are displaced by 90 degrees, or a quarter phase in time, as shown in Fig. 39, which is a diagram representing the instantaneous values of currents or electromotive forces as functions of time for the period of one cycle, under the assumption that the currents and electromotive forces vary according to a sine curve.

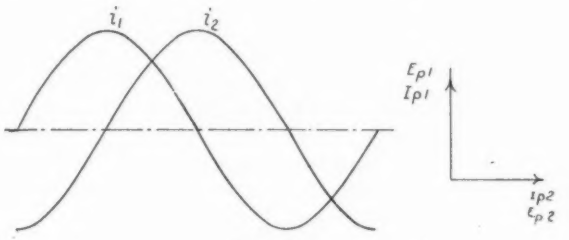


Fig. 39.

The vector diagram shows E_{p1} and I_{p1}, in time phase with each other, and lagging one-quarter phase behind E_{p2} and I_{p2}.

Fig. 38 is sometimes called a single plus system and is sometimes marked + to distinguish it from the double plus system # indicated in Fig. 40. For the same assumptions as in Fig.

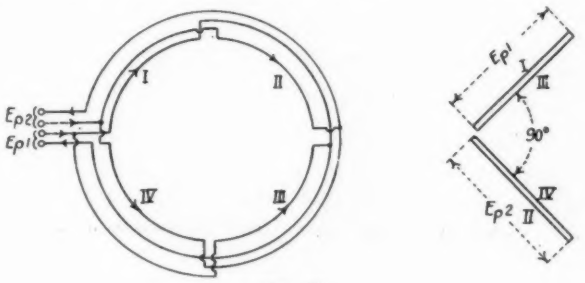


Fig. 40.

38 the electromotive force is reduced to half, while the current is doubled.

Two-Phase, Three-Wire Systems.—In order to save one line the four sections shown in Fig. 37 are sometimes connected as shown in Fig. 41. The winding potential diagram is given and it can be easily seen that the resultant voltage between points A, B is

$$E_l=2E_p\cos 45^\circ=2E_p/\sqrt{2}=\sqrt{2}E_p \quad\quad (16)$$

The voltage between the common point B (sometimes called the star) and the points A or C is equal to the voltage per phase.

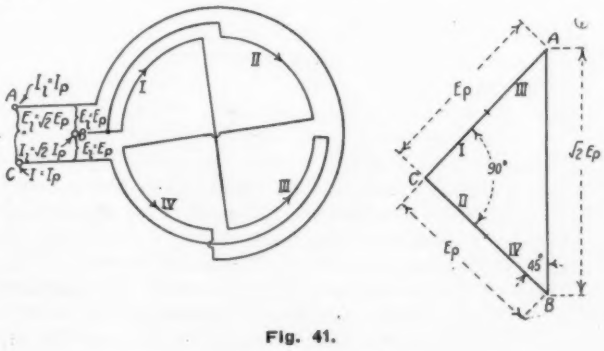


Fig. 41.

Similarly the current in the common line is the vector sum of the currents in the two phases or

$$I_1=2I_P\cos 45^\circ=\sqrt{2}I_P \quad (17)$$

The line current in the other two lines is equal to the phase current

$$I_1=I_P.$$

It is to be noted that Fig. 36 represents either a bipolar simplex lap winding or a simplex wave winding of any number

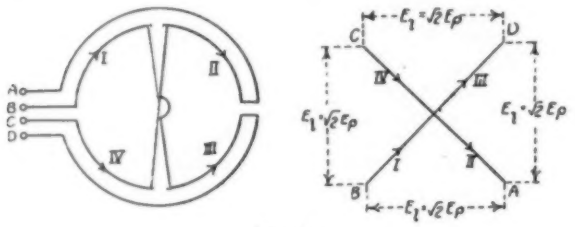


Fig. 42.

of poles. It follows that independently of the number of poles, if the number of slots is divisible by four and such that it can be connected to form a closed two-circuit winding, it will be possible to arrange it for an open two-phase single plus or double plus winding. If a four plus (or four parallel circuits for each phase) is desired, the closed winding must be a multipolar lap, a multiplex lap or a multiplex wave winding.

Four-Phase, Four-Wire System.—The four sections I, II, III,

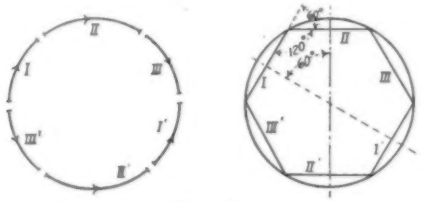


Fig. 43.

IV, in Fig. 37 can also be connected as shown in Fig. 42. The winding potential diagram is also given in the figure. The voltage between adjacent lines, such as A and B, is:

$$E_1=2E_P\cos 45^\circ=\sqrt{2}E_P \quad (18)$$

The voltage between two lines such as A and C is

$$E_1=2E_P.$$

The line current is

$$I_1=I_P.$$

Three-Phase Systems.

Three-Phase, Six-Wire System.—The ring winding R in Fig. 36 can be split in six sections as shown in Fig. 43. For a

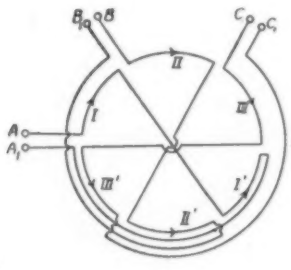


Fig. 44.

distributed winding the difference in potential between the ends of sections I, I', II, etc., is given by the chords I, I', II, etc., in the potential diagram. The left portion of Fig. 43 may again be looked upon as a space diagram and the right portion as a time-phase diagram. The voltages in sections I and III are displaced by 120 degrees, while the voltage in sections I and I' are in time phase.

The sections in Fig. 43 can be connected as shown in Fig. 44, forming a three-phase, six-wire system. Fig. 45 shows the instantaneous values of the currents in the three phases I, II and III, in Fig. 44, under the assumption that the currents vary according to sine curves. It is to be noted that under this assumption the sum of the currents in the three phases at any one instant is zero or

$$i_1+i_2+i_3=0 \quad (19)$$

(e. g., instant AA in Fig. 45).

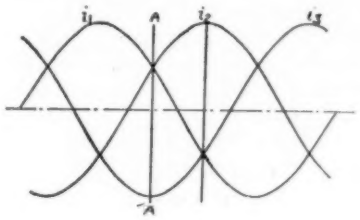


Fig. 45.

Three-Phase, Four-Wire System.—This is obtained by combining the return leads A_1, B_1 and C_1 to one single wire, as is shown in Fig. 46. The common return is also called the neutral and the whole system is sometimes called a three-phase star or Y-connected system with the neutral brought out. The voltage between any lead A, B, or C and the neutral is equal

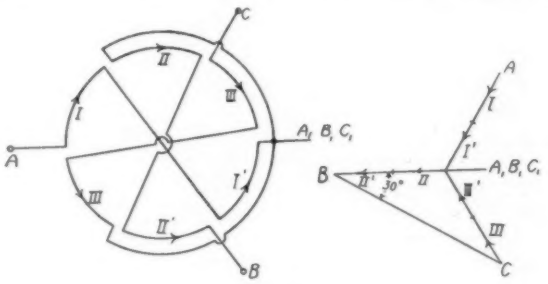


Fig. 46.

to the voltage per phase. The voltage between two lines such as BC is

$$E_1=2E_P\cos 30^\circ=2E_P\sqrt{3}/2=\sqrt{3}E_P=1.73E_P \quad (20)$$

The current in each line is equal to the phase current or

$$I_1=I_P.$$

According to formula (19), as long as the currents are sine-shaped no current will flow in the neutral, but as soon as the currents in the three phases are unbalanced or the shape of

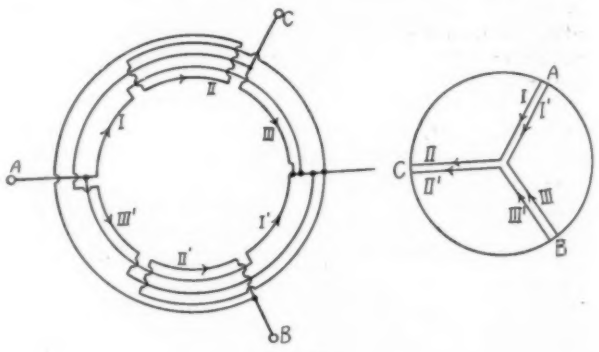


Fig. 47.

the curve departs from the sine shape the neutral will carry current.

A Three-Phase Star or Y System.—This is obtained by omitting the neutral in Fig. 46. The winding potential diagram remains the same as shown in Fig. 46 as long as the phases are balanced. Fig. 46 would also show the potential diagram for a single Y or single star. Fig. 47 represents a double-circuit star or double Y, sometimes marked YY. In this system the

three phases are no longer independent and each phase can be considered as using the other two phases as return. In case of unbalancing the vector sums *AB*, *BC* and *CA* are no longer equal to each other.

Three-Phase Mesh or Delta (Δ) *System.*—Referring to Fig. 43, we note that the electromotive forces e_I, e_{III}, e_{II}', are dis-

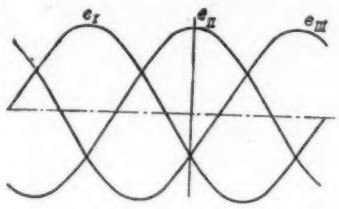


Fig. 48.

placed from one another by 120 degrees. Assuming the instantaneous values of these electromotive forces vary according to sine waves, we can represent this variation in function of time by the curves shown in Fig. 48, which are similar to curves shown in Fig. 45. It can be easily seen from Fig. 48 that

$$e_I+e_{II}+e_{III}=0 \qquad (21)$$

at every instant. It follows that as long as the electromotive forces are sine-shaped no current can flow in the circuit formed

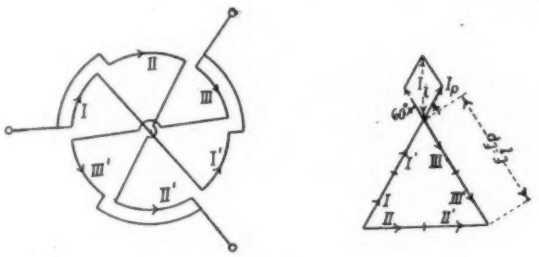


Fig. 49.

by connecting the sections I, III and II′ in series. This connection forms a delta or mesh-connected winding and is shown in Fig. 49. From the potential diagram it can be seen that the line voltage equals the phase voltage or

$$E_l=E_p.$$

The line current

$$I_l=2I_p\cos 30°=2\sqrt{3}I_p/2=\sqrt{3}I_p.$$

Fig. 49 represents a single delta(Δ), but we can cannect the sections shown in Fig. 43 to a double delta (ΔΔ) as shown in Fig. 50, in which case, under the same conditions, we obtain half the voltage and double the current per phase.

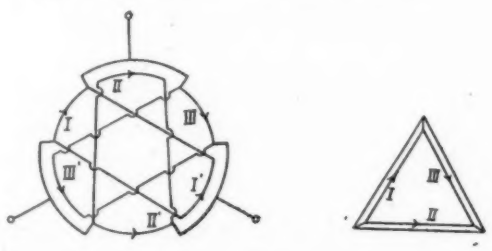


Fig. 50.

Since Fig. 36 represents either a bipolar simplex lap winding or a simplex wave winding of any number of poles, it follows that a single-circuit or double-circuit open wave winding can be obtained with any number of conductors divisible by three, that would give a closed wave winding. If a three-phase winding with three or more circuits in parallel is desired, we have to start from a multipolar lap, a multiplex lap or a multiplex wave winding.

Equation (21) holds good only as long as the electromotive forces e_I, e_{II}, e_{III} are sine curves. If this is not the case, the equation (21) does not hold and an internal current will be allowed to flow, hence the preference for the star winding in practice.

In Figs. 36 to 50 we assumed the windings to be distributed. If the winding is placed in slots, then instead of the arc *I* representing the algebraic sum of voltages induced in the winding section *I* (see Fig. 50) we would have a broken line such as is shown in Fig. 51 for four slots in section I.

Fig. 51.

Six-Phase, Star-Connected Winding.—The sections of Fig. 43 can also be connected to form a six-phase star winding, as shown in Fig. 52. It can be seen from the potential diagram that the line current is equal to the phase current $I_l=I_p$. The voltage between two alternate lines is

$$E_l=2E_p\cos 30°=2\sqrt{3}E_p/2=\sqrt{3}E_p.$$

Between two adjacent lines we have $E_l=E_p$ and along a diameter we have

$$E_l=2E_p.$$

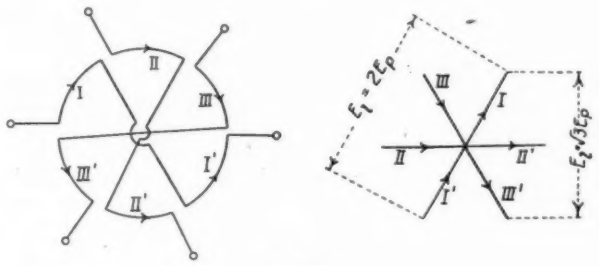


Fig. 52.

Polyphase Windings with Lattice End Connectors Lap or Wave Wound.

The polyphase winding with lattice end connectors can be considered as a modification of the closed windings. By cutting the closed winding open in several places and connecting the resulting winding sections as has been explained above, we obtain the open windings. The formulas developed in connection with the closed windings will be used in more complicated cases for drawing up the conductor diagram. For a given conductor diagram the shape of the coil leads, whether lap or wave, has no influence on the electrical characteristic of the winding. We distinguish two cases.

(1) If the original closed winding is a multiple winding we will obtain as potential diagram as many circles as there are pairs of poles and the winding diagram will repeat itself after every pair of poles. (2) If the original closed winding is a wave winding, the potential diagram is one circle for each two circuits of the wave winding independently of the number of poles.

In the first case the open winding will have an even, whole number of slots per pole and phase. In this case the laying out of the conductor diagram is easy and does not require going back to the closed winding or any other special rule.

In the second case, the number of slots per phase under the different poles may be different. The total number of slots divided by the number of poles and phases is a fractional number. In order to obtain a symmetrical *n*-phase winding the number of conductors must be a certain multiple of *n* and the laying out of the conductor diagram requires going back to the original closed winding or other special rules.

(To be continued.)

Georgia Legislature Creates Board of Electrical Examiners.

The Georgia Legislature has passed the bill providing for the creation of a board of electrical examiners and which was outlined in a recent issue. The examiners will be appointed by the Governor shortly. The measure, which received the endorsement of the leading electrical engineers of the state, met only slight opposition.

The Legislature also passed a measure providing that the Secretary of State can issue charters for interurban railways operated by either electricity or gas. By an amendment no road can be built paralleling the Western & Atlantic Railroad, which is owned by the State.

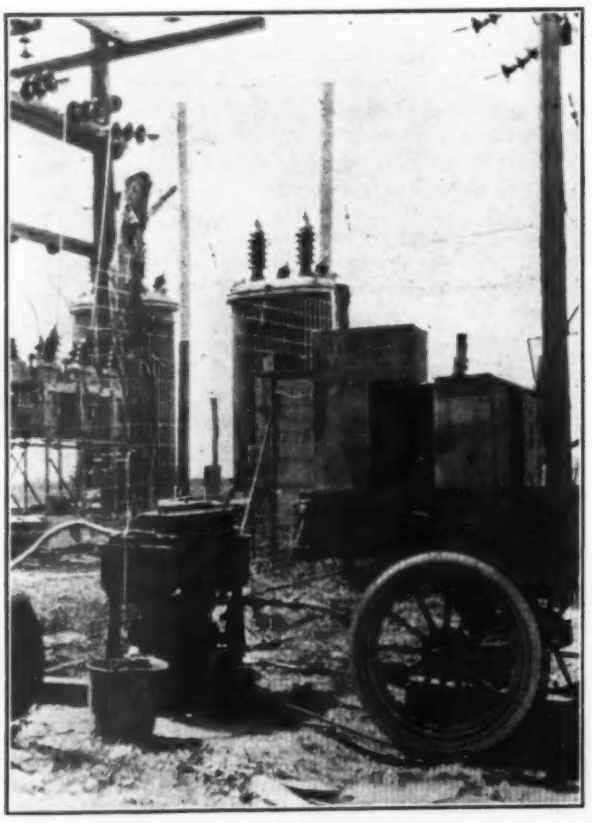
Cleaning a Marble Switchboard.

The following method has been found by me excellent to keep clean a large marble switchboard which has become dirty from exposure in an engine room. I first go over one panel of the board with a sponge dipped in a weak solution of oxalic acid and water. I then quickly wash this off, using the sponge and clear water. The next step is to go over the panel with a cloth saturated with a mixture of French chalk and water. The last step is to go over the panel with clean cotton waste which restores the original luster. Each panel is treated in the same manner in turn. Four ounces of oxalic acid to a gallon of water is a satisfactory solution for the first step of the process.

M. J. Moriarty.

Novel Method for Pumping Oil in a Transformer.

A novel use for a "Ford" is shown in the accompanying illustration. The rear wheel has been belted to a small oil-filter pump which is used in connection with the filling of large transformers.



Automobile Used to Operate Oil Pump.

Among the Contractors.

Russell & Company, electrical contractors, 444 Columbus Avenue, New York City, have the contract for a large residence to be erected at 52 East Sixty-fourth Street, New York City. The contract calls for electric light and power wiring in rigid conduit, intercommunicating telephones, electric annunciators, high-grade switch and panelboards in fireproof cabinets, and electric plate warmer and fixtures.

H. J. Olson, who recently opened an electric shop in Warren, Minn., has secured the contract for the installation and equipment of an electric-lighting plant for the village of Middle River. Mr. Olson has also secured contracts to wire 50 of the business houses and residences.

C. B. Larson has purchased the electric shop formerly conducted by George Jordan in Virginia, Minn.

Whalen, Hulet & Company, owners of the Minot (N. D.) Electric Company, have organized the Berthold Electric Company at Berthold, N. D. The latter company will do electric wiring and carry a stock of fixtures and appliances.

The United Electric Construction Company, Philadelphia, Pa., has been awarded a contract for electrical work in the new building to be erected on Market Street by the Colonial Trust Company.

A $7,000 contract for the lighting system in the new Church office building in Salt Lake City, Utah, has been awarded to Eardley Brothers of that city. The contract covers all lighting fixtures, brackets, etc., throughout the building. A semi-indirect system will be used, the fixtures having solid bronze trimmings and being of special etched glass.

M. L. Bayard & Company, of Philadelphia, Pa., have been awarded the contract for extensions and improvements to the municipal power plant in Vineland, N. J., on a bid of $93,000.

J. B. and C. A. Hutchinson, Trenton, N. J., will establish a new electric repair shop on South Warren Street.

The Pennsylvania Railroad has awarded a contract for the erection of a new power-house at the Reed Street freight yard in Philadelphia, Pa., to John N. Gill & Compan, of Philadelphia, at $20,074.

The Moore-Young Electric Company, Lexington, Ky., has been awarded the contract for installation of the electric wiring system in the new junior high school building at $1,124.

The Santa Fe Railroad has awarded a contract to the Lundgren & Carlson Construction Company, of Topeka, Kans., for the erection of a power house in Chillicothe, Ill., costing $10,000.

H. W. Gilbert and J. W. Shackleford have formed the Home Electric & Supply Company, with offices and show rooms at 104 East Sixth Street, Concordia, Wis. The company will handle electric lighting fixtures and do electric wiring, and will also sell an electric lighting and power plant to be used by farmers.

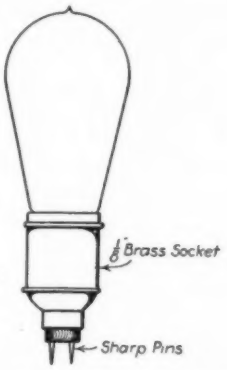
The N. C. Pickard Electric Company, Kansas City, Mo., has secured the contract for furnishing the lighting fixtures in the addition to the public library. The job amounts to $2,700. This firm reports two good-residence jobs, one in a Kansas City home and one at Leavenworth, Kans.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Test for Trouble on Extension Circuits.

In repairing electric light extensions, I formerly found it difficult to locate a break in the wires. I developed a simple method of facilitating this, by taking a one-eighth-inch brass lamp socket and screwing into its neck a dowel pin of the correct diameter. After this was placed in the socket I drove two one-inch brads through the wood which

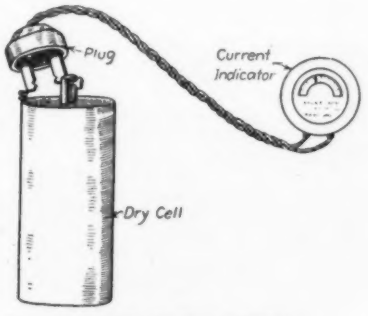


Lamp Socket Can Be Used to Test Trouble on Extension Circuits.

extended about one-quarter inch outside of the socket. I then made soldered connections between the nails and short pieces of lamp cord fastened to the socket binding screws. The nail heads were then filed sharp. A lamp was placed in the socket. By pressing the sharp points of the nails through the insulation into the stranded wire, one pin point into each side of the circuit, I was readily enabled to tell wherever the wires were alive by the lighting of the lamp. On the live side of the break the lamp lights, but of course does not beyond the break. W. Kleiber.

Simple Battery Tester.

Herewith is a sketch of a battery tester which is simple and also very handy, especially when there is a large number of dry cells to be tested. It is composed of the upper



A Simple Battery Tester.

part of a separable plug, such as the Hubbell, it fits across the cell as shown in drawing. There is no trouble in changing polarity and it also is a very quick way of testing a considerable number of cells.

S. Bernstein.

Making Holes in Slate Without a Drill.

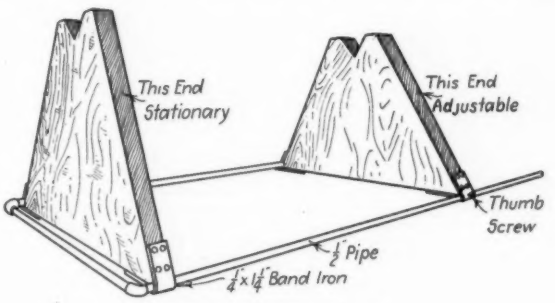
To make a hole of any size in slate, mark off the hole and then hold the piece of slate over the end of a board or two by four and, using a nail, punch and a light hammer, make holes about one quarter of an inch inside of the mark by striking the punch light, sharp blows. The slate should be so held that the punch is just beyond the edge of the board and not over it. By making the holes close together, say one-quarter inch, the opening is made and the hole may be finished by a reamer or a file of suitable size and shape.

To make a straight cut in slate, make a series of holes with the punch just off the line and then finish with a file.

L. M. Dellinger.

Adjustable Armature Rack.

The accompanying sketch shows the construction of an adjustable armature rack that can be easily made in any electrician's shop. The end pieces are wood boards that are held to the pipe base frame by means of 1.5 by 0.25-inch band iron. One end is stationary and the other



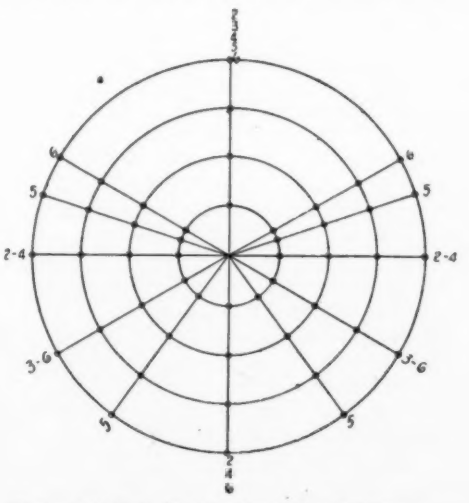
Adjustable Armature Rack.

is made to slide back and forth, being fastened at any desired point by thumb screws at each side. The pipe frame is made of one-half-inch pipe and ells.

H. A. McCarter.

Assembling a Chandelier.

A good way to divide a chandelier spinning in order to get the drill holes properly placed is to make a templet of heavy cardboard or wood and put a nail hole in it in order



Good Way to Divide Chandelier Spinning.

to hang it up over the bench. This templet is divided as shown in the accompanying diagram, and by laying the spinning on the circle of the proper size the spacing can be marked on the circumference.

Carl M. Newman.

THE DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-Keeping for the Dealer in Electrical Goods

ENLIVENING TRADE BY BEING ALIVE TO EVERY BUSINESS OPPORTUNITY.

One Method of Getting the Public Acquainted with a Merchandising Store—Other Suggestions.

By Ira R. Alexander.

A dealer in electrical merchandise should be alive to every opportunity for attracting the attention of the public to his wares. Recently in Denver, Colo., a very good example of attracting notice by an out-of-the-way method was carried out by the Denver Gas & Electric Company, which invited the Knight-Campbell Music Company, of the same city, to demonstrate all of its musical instruments operated by electrical power, in the electric company's salesrooms. The music store accepted the invitation and for a week or so gave a free concert at the store every afternoon and evening.

During the time the concerts were in progress at the store thousands of people visited it, many of whom would not have come had it not been for the extra attraction. The Denver Gas & Electric Company received considerable advertising, and the people that visited the store had an opportunity of seeing the large stock of electrical merchandise on display in the salesrooms in which the concerts were given. It is needless to say that the people saw many things they wanted, and a large number of sales were made to people who had entered the store with no thought, whatever, of buying anything in the electrical line. There were many who received suggestions while looking over the stock that paved the way for sales that have, and will, come after the musical demonstration has been forgotten.

The Denver Gas & Electric people saw an opportunity when it presented itself and they grasped it, and in doing so they were amply rewarded. There are many opportunities knocking at the door of the electrical merchandise dealer and he need only open to them and his sales can be increased. One good way for a dealer to keep before the public is to make use of what it is thinking and talking about—both local and national events. Not long ago the writer passed a store dealing in electrical merchandise and on a large card in the window were the words: "Do You Believe in Preparedness?" This is one of the leading questions of the day, and most passersby stopped to read what was on the card. Under the first line of reading matter quoted above was a plea to the people to prepare for hot weather during the summer months by purchasing an electric fan. The window display was well gotten up and in keeping with this idea. The public is accustomed to seeing electric fans, and had it not been that the question was something that most everyone was thinking about, a large per cent of the people would have passed the store without noticing the fans. The display was made even more effective by arranging a collection of firearms in the window.

If a business firm of any kind wishes to feature a window display that is arranged to represent a room in some home and a request is made for lighting fixtures the electrical dealer should not be backward about loaning them. A well arranged display of this kind looks very attractive and customers are apt to want different things that make up the display for their own homes. Of course, the firm using the fixtures should let the public know where they were obtained by making announcement on a card placed in the window.

Some pointers that will aid dealers in electrical merchandise in seeing and making use of their opportunities are given in the following paragraphs.

Attractive window displays should be arranged and changed often enough in order that they will not lose their drawing power. A window display is a dealer's catalog.

The dealer should keep his store clean, well lighted, and thoroughly stocked with advertised goods attractively arranged. It is well to employ local newspaper advertising, billboards, posters, circular letters and other advertising of like nature. Keeping everlastingly on the job and with untiring effort, originality of ideas, and honest business methods a business is bound to prosper.

Striving to please customers in every way possible is a dealer's largest asset. A business to grow and prosper must have friends, and so the dealer should see that he obtains the friendship of the people in his territory and keeps it.

There are many ways by which a dealer can enliven trade at his store and he should be continually searching for these ways. Original ideas are the opportunities that dealers in electrical merchandise, as well as dealers in other lines of business, should never let get by—for if they are any good at all they will repay in increased sales.

Human Interest in a Window Demonstration.

An "Electric Party" was staged in the show window of the Texas Power & Light Company at Brownwood, Tex.,

Setting of "Electric Party" for Showing Use of Appliances.

during the recent celebration on the occasion of the opening of its new office.

Two young ladies were placed in the window and shown with the electric appliances in actual operation. The window was fitted up like a dining room.

The unusual display attracted much attention.

HANDLING OF ELECTRICAL GOODS AT WANAMAKER'S DEPARTMENT STORE.

The great department store of John Wanamaker in Philadelphia, Pa., affords a conspicuous example of progressive merchandising methods which could be employed to excellent advantage by electrical dealers. The electrical department of the Wanamaker store is an attractive feature of the store itself, and its volume of business in electrical wares, such as lamps, domestic and toilet appliances, and the smaller accessories, is constantly growing.

Electric lamps, of both the hanging and standard types, are always attractive and readily lend themselves to tasteful arrangement. The lamp display at Wanamaker's occupies a space about 100 by 40 feet on the fourth floor bordering the great court, the fine specimens of ornamental silk and glassware shades, with mahogany, bronze and gilded standards and housing being especially noticeable from the various floors below and above.

The hanging lamps are suspended from chains which are hooked onto sections of white-painted conduit attached to the white ceiling. Wires for connecting the lamps to the lighting circuits are run in the conduit from switch and fuse boxes on three nearby pillars.

Table lamps are tastefully arranged on handsome mahogany and oak tables, mostly carrying three to a half-dozen lamps, while some exceptionally handsome and costly lamps are set singly on tables covered with cloth of gold.

About 100 varieties of metal-trim lamps are now carried. The concern was fortunate in ordering its large stock for the season just prior to the advance in prices, and hence is offering its wares at favorable prices to the customer.

The head of the lamp department stated that the present vogue for mahogany-base lamps, both in table and floor lamps, is very pronounced in Philadelphia. More gold lamps are being sold than in the past five or six years, there having been a recent revival of interest in this type.

Silk shades are in large demand, especially for table lamps, and there is a distinct preference for candelabra lamps with silk shades. Often a housewife will order shades of several tints for the same lighting units, to provide for a number of distinctive color schemes in connection with other decorations suiting the occasion or function.

It is evident that there is a tendency away from the plain inverted type of fixture for home installations, and that the candelabra type, either in combination with the semi-indirect bowl or alone by itself, is in considerable favor among householders. The colonial effect is constantly being striven for, suiting the favorite schemes of interior finish in woodwork, hardware and decorations.

Turning to the commoner types of household appliances and devices, one finds a very elaborate display of kitchen appurtenances, a number of the larger electrically driven machines for the laundry and for house cleaning, and in addition, a line of incandescent lamps, flashlights and the more common wiring devices.

The silver and nickeled table ware is displayed in glass cases four feet high by six feet square, with mahogany framework, and containing a glass shelf, thus providing two layers of goods. Percolators, chafing dishes, grills, toasters and table stoves are of Universal, General Electric, Rochester and Simplex makes. The $6.00 Universal grill is an excellent seller, being available for use in a number of ways. Toasters are in good demand. The Redtop stove at $1.95 is being featured.

In an adequate inclosure with carpeted floor various makes of electric sweepers and vacuum cleaners are demonstrated by the young woman in charge. The makes offered are the Cadillac, Premier, King, Superb, Junior and Santo. A working specimen of the interior mechanism of the latter machine, inclosed in a circular glass frame, is on exhibition.

The larger household devices carried in stock comprise the King, Maytag, Blackstone and Horton washing machines; the Gem or Wanamaker ice-cream freezer with pulley and belt for connection with the electric drive of the Maytag washer; and several types of electric ranges.

This feature of the business is "coming fast." Though the Philadelphia central station carries all these goods in its electric appliance department, it encourages their sale by other dealers, since the more current-consuming devices placed on its lines, the larger is the lighting company's income from sales of electricity. The Philadelphia Electric Company co-operates in the installation and connection of ranges, etc., advising with the purchaser as to the advantages of separate metering. The company's rates enable a customer to obtain a progressively lower rate with the increased use of energy, and the local practice is generally to meter all energy on one meter for a household. W. B. Erb, head of the Wanamaker electrical sales department, predicts a large and increasing volume of sales in electric ranges, and also a large movement of luminous and other types of radiators, with the coming of Fall.

Fans are having a large sale the present summer. The Wanamaker store carries fans in sizes ranging from the small Polar Cub fan up to the 16-inch oscillating type.

Irons are also having a large sale, the types being the Wanamaker special iron at $3.50, the General Electric, Universal, Simplex and Rochester makes. Toilet appliances, like vibrators, curling irons, heating pads and the like, find a ready sale the year around, and are displayed in one of the half-dozen glass-fronted cabinets referred to.

The repair of damaged appliances is taken care of by an electrical repair man who understands the construction of all the apparatus carried.

Advertising of the appliances is done almost entirely through the daily newspaper advertisements for which the Wanamaker organization is famous, but in addition, the manufacturers' circulars, with imprints of the firm, are distributed at the various counters and cabinets where the wares are displayed.

At various times a "model home" is shown in connection with which the use of electric household appliances is demonstrated and lamps displayed.

Prize-Winning Window Display.

The accompanying illustration shows a window display exhibited by the Arkansas Valley Railway, Light & Power

Prize-Winning Window Display.

Company and winner of the third prize in a competition between companies operated by H. M. Byllesby & Company. The window illustrated the advantage of electricity in the gold-mining operations.

Business Hints for the Electrical Dealer

Making the Best of Conditions—Inviting Store-Fronts—The "Street-Car" Trade—Opportunities in the Storage-Battery Field—Dealers Should Exchange Sales Ideas—Modern Merchandising Methods Necessary

By G. D. Crain, Jr.

IT is seldom, indeed, that a merchant has ideal conditions under which to work. Most of the time there are obstacles to be overcome and difficulties to be solved, so that winning success is not a cut-and-dried, stereotyped proposition. Perhaps if things were easier, winning out would not be appreciated as it is when the victory must be secured in the face of severe opposition.

All of which is by way of introduction to the proposition that if an electrical dealer is dissatisfied with his store, with the local market or with any other factor in the merchandising situation, he should not become discouraged, and should not stop trying on that account. On the other hand, he should work all the harder with the material he has, so as to make up for the weak points somewhere else.

Not long ago an electrical dealer who had what was conceded to be a poor location decided that he would succeed in spite of it. Unfortunately, he could not move, because he owned the property, and could hardly have disposed of it satisfactorily. What he did was to improve it by investing $1,000 in a new store-front, with handsome, spacious and well-lighted windows and an attractive entrance. Then he set to work with good window displays, properly changed, and before long he found that his sales were growing, in spite of the disadvantage of location.

"My business has grown 50 per cent since I put in those new windows," he said, "and I have already decided that I am earning a pretty good investment on the capital represented by the cost of the store-front."

What a Modern Store-Front Means.

Did you ever stop to consider the difference between the modern, up-to-date store-front and the old-fashioned one?

In the old days when the store was little more than a place where things were "stored," and the idea of safe-keeping was uppermost in the mind of the store-builder, the front was of a character which said, "Keep out." Its small windows were of comparatively little value for display purposes, and its heavy and forbidding entrance did not invite purchasing.

The modern front distinctly says, "Come in." The windows are large and roomy, displaying the goods in an attractive style. The entrance is broad and so arranged that there are no steps to overcome in entering. Every feature is taken care of, with the result that it is easy to get into the store and easy to buy there.

Small points like these make a lot of difference in the course of a year's business.

Getting the "Street-Car" Trade.

"I dress my windows with special reference to the street-car trade," said a well known electrical dealer not long ago.

"What do you mean by the 'street-car trade'?" a friend inquired.

"Why," he explained, "a great many people pass my store in the street cars. Some of them are reading newspapers, and others are gazing at the highly-embellished car-cards, possibly. But a great many of them are looking out of the windows.

"Of course, the cars move rather fast, and one can get only a glimpse of the windows; but as my store is near the corner, the cars usually slow down as they approach my location, so that those inside have a good opportunity to take in the contents of the window.

"That is one reason why I take special pains to have attractive displays in the windows, even though the number of pedestrians who pass my store is small. I find that people on the cars see them and pay attention to them, as indicated by telephone calls and in other ways.

"Incidentally, although my location is on a second-rate street, two of the principal car lines leading to the best residence sections of the city pass in front of my store, so that I have a chance at some mighty good business by catering to the street-car trade.

"One way in which I do this is by keeping my windows lighted at night, when ordinarily I would not pay much attention to the sidewalk traffic. Then, too, I have my window cards painted in large enough letters to insure their being read from the cars. I use principally large items, and comparatively few small ones in the window, and in general I arrange the exhibits so as to make them interesting at about the distance at which it will be seen by the street-car passenger."

Opportunities in the Battery Business.

In a certain city, with a population of 300,000 people, there is exactly one concern devoted exclusively to the care of automobile storage batteries. This is in spite of the fact that there are nearly 4,000 automobiles in that community which are so equipped, and which are not only constantly in the market for service, in the way of recharging and repairs for their batteries, but also will need additional batteries later on.

The head of this concern said recently that he regards the battery field as the most promising division of the automobile accessory field. "The fact that the battery requires more attention and more expert attention than any other part of motor-car equipment," he explains, "justifies the establishment of a concern devoted exclusively to this business. Moreover, the average garage man realizes that he is not in a position to render service with regard to batteries, and he is quite willing to turn that part of the work over to the expert. We find it pays to solicit the garages, as they are thus familiarized with the fact that we are equipped to take care of their wants and that we desire their business. Though we have been running a comparatively short time, we are getting plenty of business."

Talk to the Other Fellow.

The electrical dealer should congratulate himself upon being in business where every effort put forth by everybody in the field is bound to be of general benefit.

In other words, the business to be had is created largely by means of educational work. Thus, the more work done by central stations, appliance manufacturers, dealers and others, the more business there will be for everybody.

Contrast this with other lines and the one thing which is most evident in the electrical business is that the amount of business to be had is limited only by the amount of effort put forth by the dealers in the field. When you sell an appliance, you are not taking away any of the trade which might have gone elsewhere; the chances are that you contributed to arousing the desire and establishing the demand.

This means that dealers can get together for the pur-

pose of talking over plans and exchanging sales ideas without feeling that they are in the camp of the enemy. As a matter of fact, their interests are common, and the more they work together for the development of electrical business, the more trade there will be for each dealer to enjoy.

The Dealer Can't Afford to Lag.

A certain member of the trade was recently discussing the conditions under which he is doing business, and explaining why he is aggressive in the matter of up-to-date methods of display, solicitation and advertising.

"A man in this business can't afford to lag behind," he declared. "If the electrical dealers don't keep up with the procession, they will soon find themselves out of the running. The department stores and the hardware stores and other retailers are breaking into the electrical appliance business, and they are using methods which are essentially modern and up-to-date. We can't afford to class ourselves below them by using selling plans which are 25 years old.

"It is up to us to study the requirements of modern merchandising, to find out the sort of methods which appeal to the public, and then to apply them. If this seems to run counter to ideas of conservative business, you must take your choice between being radical and getting the business, and being conservative and having a chance to go to sleep for lack of customers."

An Electric Appliance Campaign Which Produced Seven-Fold Returns.

Final report of the household appliance campaign conducted by the Northern Idaho & Montana Power Company shows a total of 1,444 appliances sold, representing a connected load of 833 kilowatts. The campaign was under the direction of A. F. Douglas, new-business manager for the Northern Idaho & Montana Power Company, in conjunction with Mr. Turnbull of the General Electric Company. A crew of four demonstrator-salesmen was employed throughout the campaign, starting at Newport, Wash., April 17 and finishing at Marshfield, Ore., June 27.

The appliances were sold at a discount of 33.33 per cent if purchases were made at the time salesman called, each customer being given one chance to purchase any appliance desired.

The net expense of the compaign was $776, representing the difference between actual traveling expenses and salaries of solicitors, and the sales profit. Estimated annual revenue from the appliance sold amounts to $5,498.40, which is approximately seven times the net expense.

Prior to starting the campaign in any division a list of customers' cards was prepared. Notations were made on the cards by the solicitors as to the number of appliances each customer possessed, special data as to unusual installations, complaints, attitude toward the company, etc. Hand bills announcing that solicitors and demonstrators would call on each customer were distributed in each town a day or so prior to their visit.

The number of appliances placed in each division of the company was as follows:

Sandpoint, Idaho	229
Kalispell, Mont.	272
Dallas, Ore.	191
Corvallis, Ore.	210
Albany, Ore.	162
Springfield, Ore.	129
Marshfield, Ore.	251
	1,444

Divided as to appliances the report is as follows:

Flat irons	612
Table stoves	698
Coffee percolators	87
Twin glower (heaters)	11
Heating pads	3
Water heaters	4
Ranges	3
Chafing dishes	5
Curling irons	2
Toasters	19
	1,444

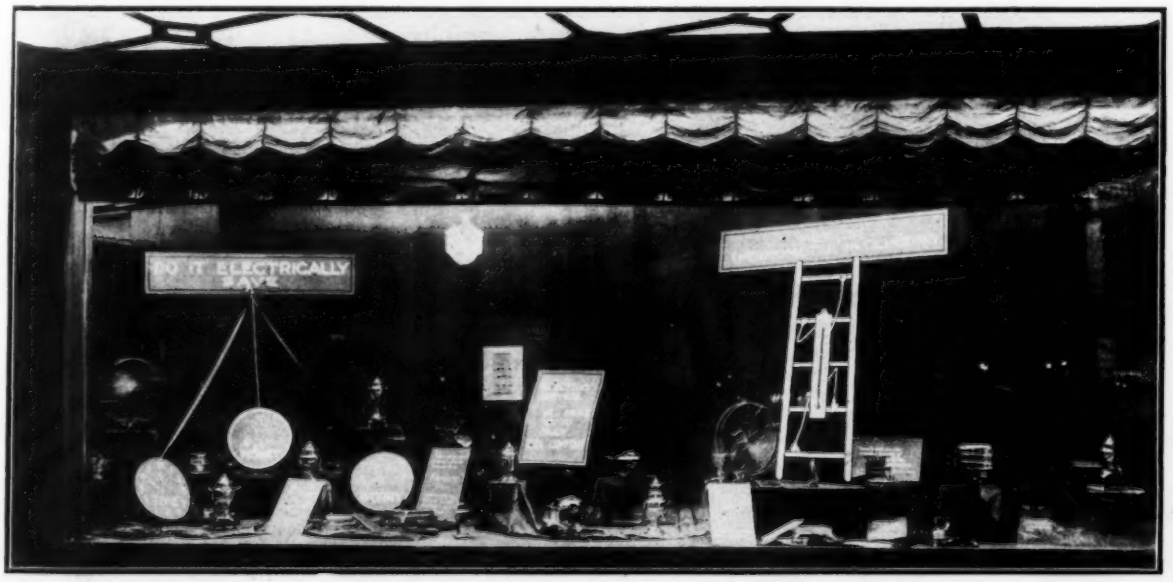
Mr. Douglas gives four basic reasons for the success of the campaign, as follows:

(1) Introducing the salesmen as demonstrators and stating in all advertising that these men should call at the home and demonstrate the various appliances.

(2) Demonstrators being equipped with good literature and a blue-print book covering all household electric appliances.

(3) Demonstrators being fully advised before starting the work as to the proper application of each appliance, the mechanical structure of same, the rate of charge for current, and the cost of operating each appliance.

(4) Demonstrators being supplied with customers' cards, and requiring a complete report on 35 customers each day from each salesman.



Commonwealth Edison Company's Display in Its Adams Street Electric Shop During the Fan Season.

The warm weather in Chicago during July and August served to make the window display shown in the illustration highly seasonable. While the display was by no means wholly responsible for the unprecedented demand for fans, it aided materially in selling 1,646 fans in one month, 1,037 of them being sold on July 27, 28 and 29. Under the popular slogan, "Do It Electrically," cards announced that this was a means of saving time, money and worry.

BOOK REVIEWS

"Power Transmission by Leather Belting." By Robert Thurston Kent. New York: John Wiley & Sons, Incorporated. Cloth, 114 pages (5x8 inches), 31 illustrations. Supplied by Electrical Review Publishing Company, Inc. $1.25.

The importance of belt maintenance has been more fully appreciated during the present era of shop efficiency than ever before, and practice in this respect has undergone some radical changes. This volume treats the subject from the standpoint of up-to-date practice, being based largely on the experiments of Taylor and Barth. The book should be found especially useful to shop foremen, most of whom can study the chapters on belt maintenance and methods of fastening to advantage. There are many valuable tables and practical directions.

"Value for Rate-Making." By Henry Floy. New York: McGraw-Hill Book Company, Incorporated. Cloth, 322 pages (6x9 inches), 5 illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $4.00.

"Value for rate-making!" What is value, and why should the value upon which rates are based differ from the value for taxation purposes and for sale? Does the gross or net revenue determine the value of a public utility, or does the investment cost determine the rates? These are some of the questions involved in valuing public utilities.

The book by Mr. Floy is timely and valuable in that it shows clearly these and many other difficulties that confront regulating bodies and rate makers. On the one hand we have the stockholder who considers it impertinent meddling on the part of the public when he is not permitted to use the property he has developed as he sees fit; and on the other hand the public insists that the value upon which the stockholder wants returns is of its own creation, and that the stockholder is not entitled to benefits derived therefrom. The legal restrictions that govern both these parties are exceptionally well summarized in this book. Quite often the public forgets the fact that courts have promulgated certain decisions and dicta which must be followed in valuation proceedings. This the author shows clearly and effectively. He shows by numerous citations of court decisions that the whole process of valuing a public utility is as much, if not more, a judicial and legal as an engineering proceeding. This is a truth too commonly not considered.

The question of Land, Paving and Water Rights is discussed very clearly by the author and he shows how courts and rate commissions differ in their interpretation of laws and the propriety of valuing these items.

The writer would have been pleased to see a fuller discussion of the most important question now confronting rate regulating bodies, namely: Shall the utilities be permitted, or are they entitled to, a return on the "unearned increment?" This is the question that underlies many, if not most, controversies between the public utilities and the municipalities. In a recent number of the *Utilities Magazine* it is stated that "the interest on the unearned increment in land values alone as claimed by the carriers would add $36 to the freight on every car originating in or destined to Oklahoma City, and $5.77 for every car of freight passing through the city. If the entire freight terminals were placed beyond the limits of Oklahoma City, the freight destined to or originating within the city could be transported by motor trucks or teams at a much less expense to the shippers than it will cost to pay interest upon the unearned increments of the terminals as utilized by these methods."

This is a question of fundamental importance in all valuation proceedings, and if the "cost of reproduction" basis is held to be correct, then it would seem that public ownership would be the wisest solution. Mr. Floy considers it only fair that the public utility corporations should be allowed returns on the unearned increment, and in this contention he is sustained by many court decisions to which he refers. His reasoning is sound on the assumption that a public utility is a private business.

The book is a most concise and clear treatment of the valuation problem and it will be of great value, not only to engineers and lawyers who may be engaged in valuation proceedings, but to city and other municipal officials, laymen and others who wish to understand more fully the relations between the public and the public utilities.

C. M. JANSKY.

"The Engineer in War." By P. S. Bond. New York: McGraw-Hill Book Company, Incorporated. Flexible imitation leather, 187 pages (4¾x7¼ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc. for $1.50.

The author of this volume is an army officer and the material is reprinted, with revisions and additions, from *The Engineering Record*. The aim of the book has reference to the training of the civil engineer and contractor to meet the military obligations of citizenship. These obligations are discussed and the duties of the military engineer elaborated. Separate chapters are devoted to such topics as stream crossings, roads, fortifications, demolitions, map sketching and sanitation. The work of the signal corps, which brings in essentially electrical applications, is not mentioned. A perusal of the book gives a good general idea of the duties of the military engineer, and the steps which should be taken by the civilian engineer in preparation for service in case of need.

"How to Build Up Furnace Efficiency." By Joseph W. Hays. Tenth edition, revised. Chicago: Joseph W. Hays. Paper, 154 pages (4¾x7¼ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc. for $1.00.

Information upon the proper handling of steam boilers and their furnaces is now so generally available that there is little excuse for the inefficient handling of this end of the power plant. It must be admitted, however, that inefficient operation is more the rule than the exception, especially in small plants, and a new edition of the helpful directions by Mr. Hays will be welcomed by many a manager who does not know what becomes of a considerable percentage of his coal. This exposition of the art of combustion is written in as popular a style as is possible with a technical subject, and is intended for others than engineers. Directions are given for locating and stopping fuel wastes, and the use of suitable measuring apparatus in the boiler room, such as draft gauges and analyzers, is strongly advocated. An appendix deals with the use of oil, gas, wood refuse and other fuels.

"Electric Wiring Diagrams and Switchboards." By Newton Harrison, with additions by Thomas Poppe. Second edition, revised and enlarged. New York: The Norman W. Henley Publishing Company. Flexible imitation leather, 303 pages (4½x6¾ inches), 130 illustrations. Supplied by Electrical Review Publishing Company, Inc. for $1.50.

This volume is intended for the electrical contractor and wireman who is entirely unfamiliar with the elements of electrical engineering or even the fundamental facts of electrical phenomena. The considerations which determine the layout of electrical circuits are stated in very simple fashion and of course the subject is treated superficially. The present edition has had two chapters added, one dealing with transformers and the other with meters. These subjects are treated very briefly—so much so that wrong ideas might easily be obtained as to the Scott transformer connection and the construction of an instrument transformer. Although the remainder of the book is supposed to have been revised, the chapter on incandescent lamps is based entirely on the carbon lamp and the tungsten lamp is not even mentioned. Equal carelessness is displayed upon the title page, where Mr. Poppe is stated to be an "Associate Member Institute Electrical Engineers," but his name does not appear in the current membership list of the American Institute of Electrical Engineers.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

New Lamp Dimmer—The Anylite Regulator.

An improved form of individual lamp dimmer has been placed on the market under the name "Anylite Electric Regulator." It derives this name from the fact that it can be used to give any degree of light with any Edison medium-base incandescent lamp up to 60 watts, regardless of whether it has a carbon or metal filament. The accompanying illustration shows the compactness of the

New Individual Lamp Dimmer.

device, which consists of a combined plug and socket with series resistance and a sliding contact adjustable by means of two cords so as to gradually cut in or out any amount of this resistance. This regulator is merely screwed into the lamp socket and the lamp screwed into the socket part of the regulator. It is well ventilated and constructed.

This device can be used in any place where it is desirable to turn down the light of a lamp, particularly in hallways, bathrooms, bedrooms, invalids' rooms, etc. Giving such smooth and easy regulation it permits leaving a dim light by which a person may find his way about without stumbling or groping about to find the switch or socket key. The light can be instantly turned up to full or any desired intermediate brilliancy. This is a specially valuable feature in the sick room, as has been found by the experience of several hospitals.

The Anylite regulator has been approved by the National Board of Fire Underwriters. It is manufactured by the Anylite Electric Regulator Company, of Fort Wayne, Ind., and Walla Walla, Wash. A. Hall Berry, 97 Warren Street, New York City, is eastern representative.

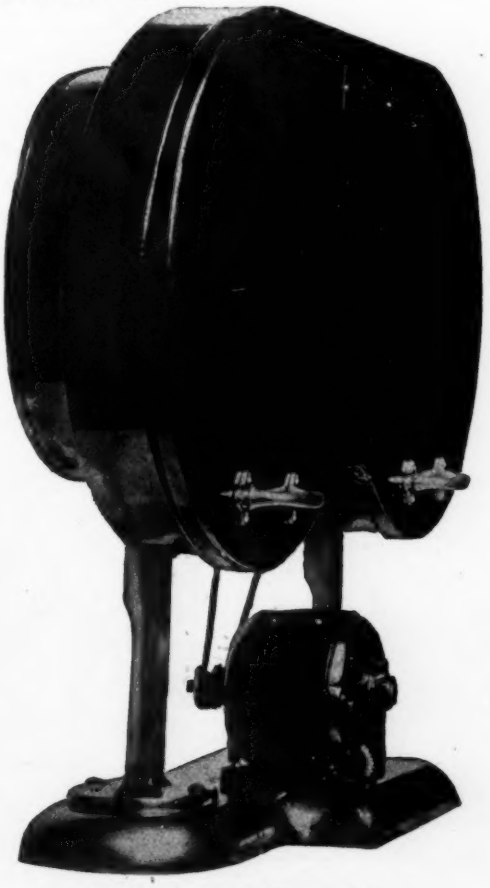
Automatic-Stop, Motor-Driven Picture-Film Rewinder.

The rewinder illustrated, called the Horting, was devised to assure absolute safety in the winding and rewinding of motion-picture films. It is made by the Automatic Film Rewinding Company, Incorporated, Harrisburg, Pa., and is the only machine approved by the National Board of Fire Underwriters that entirely incloses the film when rewinding. This machine is driven by an inclosed Westinghouse motor, selected as best adapted for the work both from principle of operation and construction. The cost of operation is said to be less than five cents a day based on a 12-hour performance.

As shown by the illustration, this rewinder is very simple. It is supported by two uprights which rest upon an iron base, giving proper rigidity without undue weight. There are two magazines, one larger than the other. Each is a separate inclosed compartment, with a cast aluminum cover or protector designed to conform to the shape of the reels. The larger magazine is used for the reels during rewinding; the smaller one contains the operating mechanism.

The machine will take reels of 2,500 feet or less of any make, and will operate only when the magazine covers are closed, unless set for examination or inspection of the film. This feature makes it foolproof and checks the possible explosion of exposed films due to carelessness. The attention of the operator is not required at the end of a film, as the machine will automatically stop when the film has been completely rewound. Should the film break while the machine is in operation, the rewinder will automatically stop at the point where torn and allow splicing of the film, after which it will proceed to rewind the balance of film on reel.

Operators and owners are often given a great deal of annoyance by the presence of "rain" on the screen. This is caused by dust and particles of dirt which collect on the face of a film during rewinding, when such rewinding is done in the ordinary way. As the Horting rewinder winds the films under cover, perfect pictures are assured because no dust can get on the film. It has an additional advantage in that it protects films from mutilation.



Horting Picture-Film Rewinder.

The Marshall Oil Engine.

Among modern internal-combustion engines, the Marshall oil engine is classified as a high-grade, self-contained prime mover and is one of the most recent English designs, being laid out on practical lines and at the same time scientifically constructed for the most effective and economical use of various oils. The recognized good qualities of the Gainsborough works where these engines are made are applied here in two types, which are illustrated herewith.

The stationary engine (Fig. 1) is well adapted for belt driving electric generators or all kinds of machinery in small factories, sawmills, brickyards, creameries, and all other places where space, cleanliness and economy are taken into account. The engines are also used in supplying power for irrigation and drainage plants, pumping for water supply, refrigerating and pneumatic plants and marine signal stations. For small electric light and power plants at public institutions, theaters, country houses and the like, the fixed engines by virtue of their even running and close governing, are very suitable, and they can be used either for belt or direct drive.

The engine operates on the well established semi-Diesel system, and it will work with crude, refined or residual oils, these being chiefly by-products from the manufacture of gasoline, benzine and paraffin. The engine works on any mineral oil up to 0.92 specific gravity without any change to the spray valve, etc.; with oils above 0.92 specific gravity, an apparatus for preheating the oil is usually required so that the fuel pump can handle it. With good crude oil, the consumption at full load is about 0.6 pint per brake-horsepower-hour.

Engine bed and cylinder casing are combined in a massive casting supported on all its length on the foundation and provided with an oil channel all round. The vaporizer is of the Marshall special "bulb" pattern in which all ribs and outside fittings are eliminated. The combustion chamber is of simple make-up. No air or exhaust valves are required, and stresses due to unequal expansion are avoided. Passing over the improvements in piston and power drive parts, it may be mentioned that, among other new ideas, there is used a water valve fitted on the top of the cylinder which allows a small quantity of water to drop on the end of the piston, and to be thrown into the vaporizer at the termination of the stroke. This prevents overheating of the vaporizer and is claimed to reduce fuel consumption.

The inclosed "pendulum" governor, seen at the side of the engine, is another important feature. It is of the high-speed, spring-loaded type, driven from the sideshaft by worm gearing, and is arranged to regulate the stroke of the fuel pump in proportion to the load on the engine.

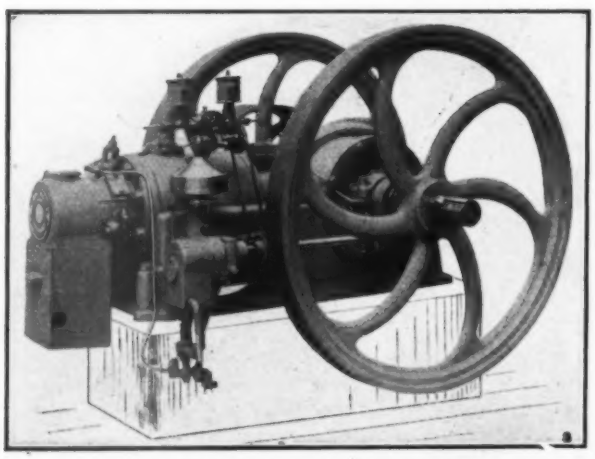


Fig. 1.—Marshall Stationary Type Oil Engine.

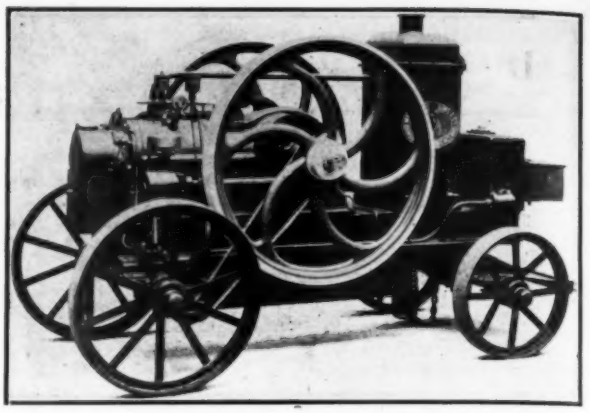


Fig. 2.—Marshall Portable Oil Engine.

By this method, a working stroke is obtained for every revolution and sudden shocks with irregular running, which invariably occurs with the "hit-and-miss" principle of governing, are absent.

On top of the engine is noticed the fuel pump which is belt driven from the sideshaft. This is of new design, and adjusted to deliver the correct supply of fuel to the vaporizer. Special attention is paid to lubrication, the system comprising: oiling rings to give automatic and continuous lubrication to the main bearings and sideshaft bearings, forced lubrication for piston and pin, combined forced and centrifugal lubrication for crank pin, besides oiling of minor parts.

Starting apparatus includes a reliable blow lamp for heating the vaporizer at start, and a compressed-air receiver and combined starting and charging valve can be supplied. The apparatus is arranged so that the receiver can be started by the engine. A self-starter is not required for the 6 and 8-horsepower sizes, but is recommended for 16 horsepower and it is necessary for 20 horsepower and upwards. Such a device saves hand labor in starting and enables the engine to be quickly and easily put to work. An outside cast-iron exhaust muffler can be used, and other outside parts are the gravity cooling-water tank and the fuel-oil tank, connected by suitable piping.

Engines are built in ten sizes ranging from 6 to 50 horsepower. The smallest size makes 400 revolutions per minute and weighs about one ton. The largest size runs at 260 revolutions per minute and its weight is 120 tons.

The present application of the semi-Diesel system on the two-stroke principle successfully permits the economy of the high-compression oil engine, and with other advantages belonging to the reduced pressures of the low-compression engine, it possesses a marked superiority over both types as regards simplicity in mechanical parts and operation.

A very convenient portable outfit is made by mounting the Marshall engine upon a suitable four-wheel truck, as shown. In this case the engine is mounted on a steel frame of rigid construction provided with strong axles, undergear and wrought-iron wheels. The outfit is propelled by the engine itself, but when required it can also be fitted with shaft or pole for haulage by horses. There are supplied a set of chocks for holding the truck in steady position on the ground when employed for power driving.

These portable machines are very well adapted for agricultural purposes, such as driving threshing machines, cotton gins, stone breakers, pumps, farm cutters, and all kinds of power-driven devices for farm or other use. Contractors also find this type of portable engine useful, and they are now coming to be preferred to steam plants on account of being ready to work and needing no firing up;

among the work of this class that they can do is the driving of stone crushers, concrete mixers, pile drivers, saw benches and other contractors' machines.

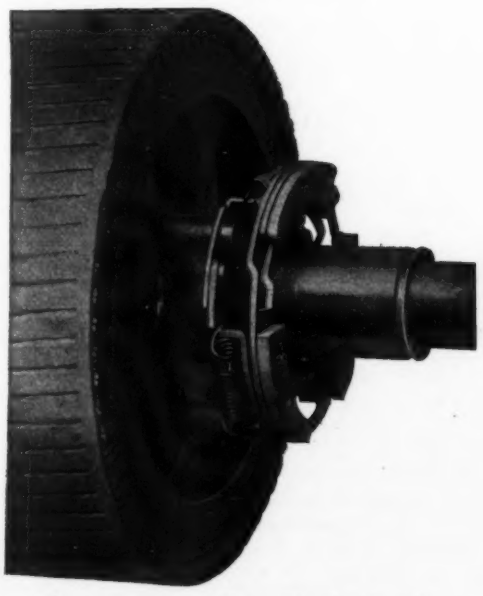
Strong tanks of good capacity for cooling water and for oil fuel are provided. The fuel tank is butted to the muffler on the frame, so that in cold weather the heat of the engine exhaust will prevent the oil from becoming too thick to flow through the strainer and oil pipes to the fuel pump. The cylinder is cooled by water circulation effected by a centrifugal pump drawing water from a tank bolted under the frame. When the engine is running, water circulates around the cylinder and passes into the top of the water cooler. The water falls by gravity through a series of wood frames fitted in the cooler, and the temperature is considerably reduced by meeting the current of air drawn upwards through the cooler by the action of the exhaust. The water returns to its tank under the frame.

The exhaust is taken to a muffler at the front of the frame and thence to another silencer at the top of the water cooler, being so arranged that a strong current of air is sent through the latter, as already mentioned. A friction clutch can also be fitted on the engine which enables it to be easily started. A clutch is generally necessary for portable oil engines, as they cannot always be arranged to drive fast-and-loose pulleys. A self-starter, similar to that used for the stationary engine, can also be provided.

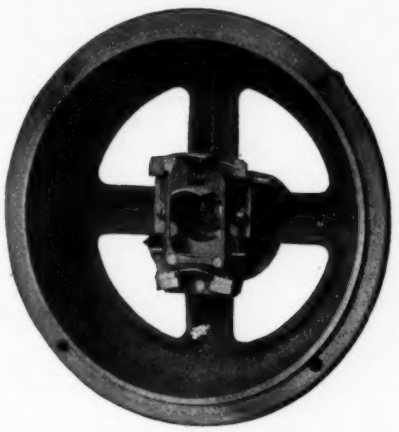
In Fig. 2 the chain drive from engine shaft to the truck axle is clearly shown. Below the truck is the long water tank above noted. Near the front of the truck, the water cooler and the smaller oil tank are observed, with a tool box placed at the front. No less than ten different sizes of these portable engines are made, these ranging from 6 to 50 horsepower. The engine shaft carries two flywheels, and on one side there is also mounted a pulley.

Starting Switch for Split-Phase Motors.

Single-phase induction motors using the split-phase method of starting require a switch to cut out the starting winding. This switch is always arranged to operate by centrifugal force just before the motor reaches full-load speed. The old types of switch, which was operated by the contrifugal force of the contact fingers, while reliable for light service, did not meet the increasing heavy demands put upon single-phase motors.



Rotating Part of Motor-Starting Switch.



Stationary Part of Split-Phase Motor-Starting Switch.

The new switch developed by the Westinghouse Electric & Manufacturing Company. East Pittsburgh, Pa., for use on its small single-phase induction motors has been designed for great endurance and reliability combined with simplicity.

The switch consists of two parts, a stationary part mounted on the motor bracket, and a rotating part mounted on the shaft. The former consists primarily of one stationary and one movable punching, each of which carries two heavy copper block contacts insulated from the punching, the contacts on the upper part being short-circuited by a phosphor-bronze spring. This part is free to move up and down, thus opening and closing the circuit with the two blocks on the stationary part. The movable part is held in either of its extreme positions by means of two steel springs near the upper part of the switch which also give it a certain amount of overtravel, so that when it is pushed in one direction through about half of its travel it will jump the remainder of the way.

The operating mechanism for the switch is mounted on the shaft and consists of three weights arranged in an approximate ring. These weights run between two lips on the sliding part of the switch. When the motor slows down, the springs pull the weights together and they then strike the lower lip, throwing the switch into the closed position. Owing to the overtravel of the switch the lips move out of contact with the ring in both the open and closed positions so that the only time the rotating part is touching the stationary part is at the moment of transition.

This switch makes a quick clean break, the contacts are large, permitting quick radiation of heat, and by thus keeping the contacts cool reduces arcing to a minimum. The contacts are designed to have a wiping action which keeps a clean contact surface.

The mounting of the stationary element is metal, insuring correct alinement and spacing, while the only insulation used is the Bakelite-Micarta used to separate the contacts from the punchings. The illustrations show both parts of the switch mounted, the revolving member on the shaft and the stationary member on the bracket.

One of these switchs selected at random from stock was operated 1,000,000 times at more than full-load current and at the end of the test was still in excellent operating condition.

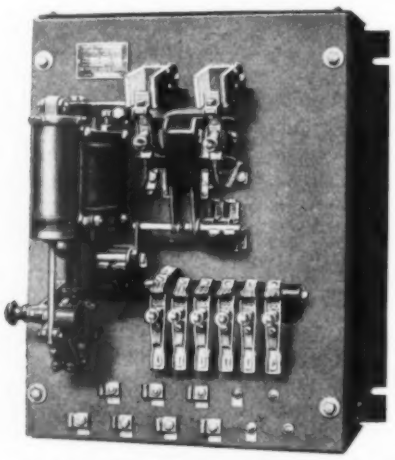
Automatic Starter and Speed-Regulating Controller for Slip-Ring Induction Motors.

The conventional type of self-starter for slip-ring motors consists of a double or triple-pole solenoid main switch for closing the primary circuit, and one or several similar switches for controlling resistance in the secondary

circuit of the motor. From the standpoint of cost, it is desirable to keep the number of secondary switches down to a minimum. Motors of capacities up to 20 or 25 horsepower are frequently started with only one step of resistance in the secondary circuit. In this case the starting-current peaks are very high, which in many cases is objectionable, particularly when small motors are connected to the same feeder as a lighting load, which thus has imposed on it the annoying voltage drops occasioned by the starting of motors in the same line. Another objection to this type of self-starter is the high current consumption for the continued energizing of the solenoids.

Another type of self-starter which increases the possible number of starting steps at a reasonable installation cost has for the control of the secondary a single solenoid which moves a number of individual switches that cut out the resistance in the secondary circuit in succession. The solenoid operating these switches is usually connected behind the switch controlling the primary circuit and the solenoid has to be energized all the time while the motor is in operation. This involves quite a consumption of energy, which again is serious in case of small motors.

Another disadvantage of this type of self-starter is the fact that the solenoid plunger has to move slowly during the accelerating period against the action of a dashpot or similar retarding device. It is a well known fact that alternating-current solenoids have a great tendency to be noisy, particularly if the magnetic gap between the plunger and the stationary magnet structure is not closed. The result is that such devices are exceedingly noisy during the accelerating period. Such a device would also fail entirely if it were desired to run the motor at reduced speed with some of the resistance in series.



New Alternating-Current Automatic Starter and Speed Regulator.

The current taken by this solenoid is practically inversely proportional to the air gap and therefore the greater the opening of this air gap, that is, the lower the speed at which the motor is operated, the higher would be the current taken by the self-starter. This current in some cases may exceed even the motor current.

All these objections have been overcome in the automatic starter shown in the accompanying illustration and made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This self-starter consists of a double-pole solenoid main switch for closing the primary circuit and a number of switches operated by a common solenoid for controlling resistance in the secondary circuit. This solenoid, however, is operated in a manner different from that of the conventional solenoid-operated self-starter in that when the circuit to the self-starter is first closed, the solenoid is energized and it lifts its plunger instantly. This operation inserts all the resistance in the secondary circuit of the motor. After the solenoid plunger has reached its highest position it closes a pilot circuit which causes the primary switch to close and connect the motor across the line with all resistance in series. The closure of the primary switch in turn opens the circuit to the pilot solenoid, so that the latter now is without current. As the pilot solenoid pulls up to its highest position it is latched there until its current is cut off by the closure of the primary solenoid and the latch is automatically released. The plunger of the solenoid is then free to drop against the action of the dashpot. The gradual dropping of the solenoid plunger causes the switches which control the resistance in the secondary circuit of the motor to gradually short-circuit the latter and bring it up to speed. The time of acceleration can be adjusted on the dashpot.

It will be seen that in this self-starter the only constant consumption of energy is due to the primary solenoid switch. The amount of energy taken by the secondary solenoid is negligible, as it is energized only for an instant. The electrical interlocks described above will insure that under all conditions all resistance is inserted into the secondary circuit of the motor before the primary switch closes. The motor can be started with a minimum amount of inrush current. The number of accelerating switches is six, two for each phase of the secondary circuit, and as the phases are cut out in rotation the motor accelerates with seven distinct speeds.

The motor may be run at different speeds between zero and maximum speed and this can easily be accomplished. Instead of connecting the shaft carrying the accelerating switches directly to the pilot solenoid, the former is connected to the latter through two levers pivoted at the same point, one of which is equipped with a segment provided with a number of holes and the other is provided with a pawl which can be slipped into any one of these holes. By this means it is possible to engage the two levers in different relative positions and this causes a variable number of switches to be closed when the plunger has reached its lowest position. It is thereby possible to run the motor at any one of seven speeds desired without having the pilot solenoid energized throughout operation of the motor.

The primary switch is of the Cutler-Hammer double-pole alternating-current construction. The secondary switches consist of substantial fingers making contact with stationary copper contact blocks.

The controller may be arranged for operation from any pilot device, such as a float switch or pressure regulator, or it may be operated from push buttons. The latter type of operation is particularly desirable in case of the speed-regulating controller which is used especially for printing-press and similar work. In this case it is possible to start and stop the motor from any number of places by the operation of an "on" and "off" push button at each place.

Passenger-Elevator Door and Control Safety Locking Device.

It has been estimated that 85 per cent of the accidents occasioned in the operation of passenger elevators occur at the elevator gates, due principally to the starting of elevators before landing gates are closed, and to gates being left open after the elevator has left a landing. To obviate these hazards and to make the operation of elevators safer a new device called a passenger-elevator door and safety control lock has been patented and placed on the market by the American Safety Utilities Company, 1018 Peoples Gas Building, Chicago, Ill.

The device consists of a mechanical door lock and gate mechanism at each shaft door, and a double-throw switch,

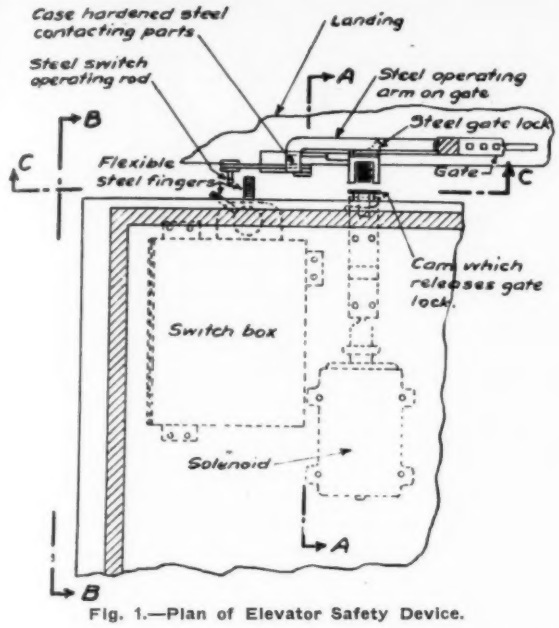


Fig. 1.—Plan of Elevator Safety Device.

a solenoid and cam, and an emergency mechanism on the car, the plan view of which is shown in Fig. 1. In Fig. 2 is shown the door lock, a hinged catch, which acts as a stop to prevent the opening of the elevator doors. When the elevator stops opposite a landing the initial movement of the door operates a switch on the car which opens the car-control circuit and shunts the current through a solenoid, the action of which, through a system of levers (also shown in Fig. 2), raises a cam that releases the door lock. This operation is practically instantaneous and does not interfere with opening the door quickly. While the door is open the control circuit on the electric car remains open and the operator is unable to operate the car either up or down. On the hydraulic type of elevator the control lever is locked while the door is open, and on the rope-control hydraulic or steam elevator the rope is locked and held in the neutral position while the door is open. Fig. 3 shows in detail the mechanism for operating the control switch on the car. When the elevator door is opened the switch-operating rod is actuated and, working against flexible steel fingers, a rotary switch is operated so as to open the control and close the solenoid circuits.

The final movement of the elevator door in closing operates the rotary switch to open the solenoid circuit. The cam, for the operation of the door lock, drops by gravity action, as does the door lock itself. The completed movement of the switch closes the control circuit and the operator is enabled to proceed.

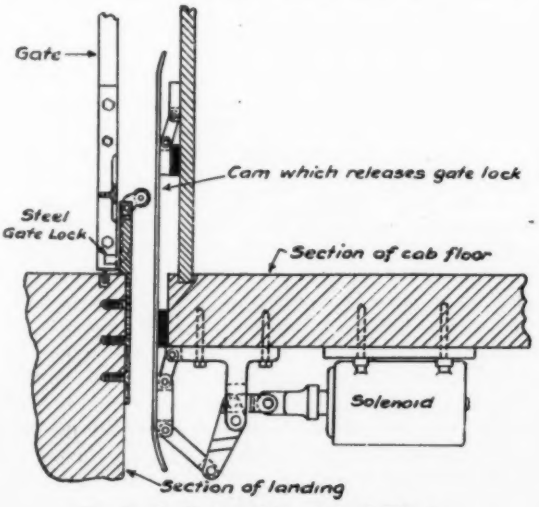


Fig. 2.—Section on Line A-A of Fig. 1.

Suitable provision is made so that in case of emergency the elevator may be operated independent of the door and control lock. By breaking the seal on a small control box inside of the elevator car the operator can close a switch that completes the elevator control circuit and eliminates the door control circuit, making the operation of the car the same as if the door control system was not installed.

Service and laboratory tests extending over a period of four months have been completed on the equipment by the Underwriters' Laboratories and approval has been made both for fire and accident. The following claims for the system were approved by the Laboratories in its report and are explanatory of the functions of the device:

The lock prevents the opening of any landing door until the car is within a predetermined distance of the landing floor, and does not permit the car to move until the door is closed and locked.

In electric elevators the control circuit of the car is opened immediately before the door or gate lock is released. In hydraulic and steam elevators the control is locked and unlocked by the same action that locks and unlocks the door.

The construction of the switch is such that the control circuit must be opened before the door-unlocking means is actuated.

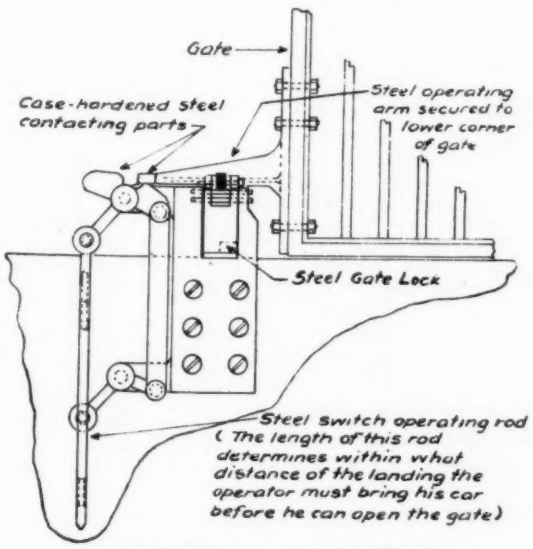

Gate
Steel operating arm secured to lower corner of gate
Case-hardened steel contacting parts
Steel Gate Lock
Steel switch operating rod
(The length of this rod determines within what distance of the landing the operator must bring his car before he can open the gate)

Fig. 3.—Section on Line C-C of Fig. 1.

Each door is independent of all the others. All doors are securely locked independent of the ordinary door latch. During normal operation the door at which the car stands is the only one that can be opened.

Only one switch is used for the elevator shaft and this is carried on the car. Means independent of the switch are provided for emergency operation of the door lock.

Any possible failure of the switch to operate would not involve a loss of the safety features, for emergency operation is provided for and any failure of the switch to operate would make it necessary to use the emergency means to unlock the door.

The length of the rod on the gate mechanism determines how near the car floor must be to the landing floor before the gate can be opened. The length of the shoe on the car determines the range of operation under emergency conditions. The rod and shoe may be made any length.

This device is mechanically strong, simple in construction and operation and absolutely foolproof, requiring a minimum of maintenance.

INDUSTRY ACTIVITIES

Bates Expanded Steel Truss Company, 208 South La Salle Street, Chicago, Ill., has prepared a treatise on Bates expanded steel poles which gives methods of manufacture and illustrations of their utility. A considerable amount of mathematical data applicable to pole-line construction is included in the booklet, together with graphical solutions of such problems.

Westinghouse, Church, Kerr & Company, engineers and constructors, 37 Wall Street, New York City, have issued a folder descriptive of the construction of terminal of the Canadian Pacific Railway in Vancouver, B. C. In this terminal is handled a combination of steam-railway, trans-Pacific and coast-wise-steamer traffic with complications due to customs inspections, immigration regulations and baggage transfers.

Macbeth-Evans Glass Company, Pittsburgh, Pa., has issued catalogs Nos. 96 and 97. These deal with Ajax-O-Lite reflectors, the former for hospital lighting and the latter for commercial lighting. These fixtures present a number of unique features, the most striking of which is that they are entirely inclosed so as to make the problem of cleaning extremely simple, thus making them especially suitable to meet the sanitary requirements of hospitals and the need for economical maintenance and operation in commercial buildings.

The A. C. Mannweiler Company, of Fort Wayne, Ind., manufacturer of miniature incandescent lamps, has added a building to its plant which doubles its manufacturing capacity. The addition of the new building has enabled the company to install new machinery, which has been very much needed in the past. The company has increased its working force and has been busy making Christmas-tree lamps since last February. The company makes a complete line of miniature lamps, consisting of nearly 100 different designs of Christmas-tree lamps, miniature automobile lamps for all makes of cars in any capacity, voltage or base.

Globe Electric Ranges Featured at Electrical Show.—Conspicuous among the dealers who maintained attractive displays in connection with the electrical show and centennial held at Peru, Ind., last week, was the exhibit of the Moseley Supply Company, which featured the possibilities of the electric range. The company's booth was visited by a large number of interested people anxious to investigate this modern and improved method of cooking. A demonstrator was in charge of the exhibit and prepared foods for the benefit of prospects and other spectators. The stoves featured were manufactured by the Globe Stove & Range Company, of Kokomo, Ind.

Woods Motor Vehicle Company, 2500 Cottage Grove Avenue, Chicago, Ill., has issued an attractive 24-page booklet on the Woods dual-power automobile. Numerous illustrations and complete specifications are given. The book cites the demand for such a car, how the car was developed and how it performs. The starting of the car is explained, as well as its operation as an electric, as a gas car, and how it runs on both electric and gas power at the same time. The simplicity of control and operation is emphasized, the reversing of the car, its non-stalling feature and the electrical equipment being explained. The charging of the battery while the car is running and dynanic braking form two interesting subjects. The economy of the dual-power operation is also pointed out. Copies of the booklet will be sent to those making request to the company.

The Cutler-Hammer Manufacturing Company's steadily increasing business in the East has necessitated the leasing of larger offices in New York City. The new offices are on the nineteenth floor of the Hudson Terminal Building, 50 Church Street, the space being nearly double that previously occupied. W. C. Stevens is manager of this office.

Utilities Fire Indemnity Exchange, St. Louis, Mo., according to an announcement by Lynton T. Block, commenced, on July 31, writing fire-insurance policies on the property of public utilities and electrical contractors. For several years the Utilities Indemnity Exchange has been accepting fire insurance and placing it as advantageously as possible for public utilities, and through its efforts a saving of over 25 per cent on the cost of such insurance has been effected. The experience on the business written, however, proved that the lines served by the Exchange were bearing an undue proportion of the fire losses and as soon as the proper amount of business had been secured a separate exchange was started. The management will be the same as the Utilities Indemnity Exchange, which has for some years specialized in liability and compensation insurance for public utilities. The feasibility of the Exchange was demonstrated by the investigation made by David L. Gaskill, secretary of the Ohio Electric Light Association, and the movement grew out of the fact that the old line stock companies refused to give any relief to the moderate size light plant through suitable reduction in cost. Special study has also been given the many restrictive clauses now contained on policies covering electrical machinery and apparatus and the new Exchange will write as liberal a policy as is consistent with good underwriting.

U. S. S. "Tennessee" to Be Propelled by Electricity.—The contract for furnishing the necessary equipment for the electric propulsion of the U. S. S. *Tennessee,* a superdreadnaught of the largest class and now under construction, has been awarded to the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. The system of propulsion being installed differs from any now in use on battleships. Instead of the propellers being mechanically connected to the driving engines or turbines, there are two steam turbines developing over 33,000 horsepower driving electric generators which furnish current to four 6,700-horsepower motors, each motor driving a propeller. Electric drive for battleships has been adopted after a careful investigation by the Navy Department to whom it presented numerous features of structural, operating and military advantage, among which are that the steam turbines developing the electric energy may be located in any desired portion of the ship, that the propelling machinery may be better protected from injury, that full power may be available for reversing, and that greater rapidity in maneuvering is made possible compared with existing mechanical systems of control. In addition to the main generating equipment and propelling motors, the contract includes the auxiliaries for the main turbine generator sets and smaller auxiliary turbine generators supplying light and power throughout the ship. The *Tennessee* will have several hundred electric motors for doing nearly all the work on board from raising the anchor to steering. Electricity will also be used for cooking, ice-making, refrigeration and numerous other purposes. In all, 37,500 horsepower of electricity will be needed, the amount required for a city of about 100,000 inhabitants.

PERSONAL AND BIOGRAPHICAL

MR. ISAAC J. NEWTON has resigned as superintendent of the Lenox (Mass.) Electric Light Company, which is owned by C. D. Parker & Company, of Boston. He is succeeded by MR. ELMER NEWTON, of Los Angeles, Cal.

MR. T. H. SOREN, recently associated with the Schenectady works of the General Electric Company, where he was for 23 years, mostly in an executive capacity, has become assistant to Vice-President Ferguson, of the Hartford (Conn.) Electric Light Company.

MR. H. V. CARTER, having disposed of his holdings in the Pacific States Electric Company, San Francisco, Cal., has resigned as president and general manager after seven years' service. He is succeeded as president by MR. T. E. BIBBINS.

MR. DAVID H. McCORMICK, manager of the Rockville-Willimantic Lighting Company, in Connecticut, has resigned, effective September 1. He has not announced his future plans. MR. JOHN ABRAM, who has been associated with the company in its Willimantic office, will have charge of the Rockville office.

MR. J. A. BOELL, formerly power engineer for the central division of the Public Service Electric Company, has been appointed industrial agent for the Public Service Corporation, with headquarters at Newark, N. J. Mr. Boell's duties will have to do with getting new industrial plants to locate in Public Service Corporation's territory, as well as giving service to those there at the present time.

MR. XEN FAGAN has recently become general manager of the Marion Insulated Wire & Rubber Company, Marion, Ind., succeeding the late MR. R. E. LUCAS, who was connected with the copper wire industry for the past 30 years or more. Mr. Fagan is thoroughly familiar with the business, having been connected with the Marion company for the past 11 years. The business will be carried on as heretofore, most of Mr. Lucas' well known policies being followed.

MR. J. W. THORNE has resigned as commercial agent of the Beaumont (Tex.) Electric Light & Power Company to accept a position in the commercial department of the Texas Power & Light Company, Dallas, Tex. Since graduating from the colleges of mechanical and electrical engineering, University of Kentucky, in 1907, Mr. Thorne has been with the General Electric Company in the testing and engineering departments at Schenectady, N. Y., and Pittsfield, Mass., and in the commercial department of the same company in Texas. In January, 1912, he accepted a position with the Beaumont company as meter foreman, later in the same year becoming commercial agent and electrical superintendent, the position he held until recently. Mr. Thorne is at present investigating the possibilities of electric drive in the Electra (Tex.) oil field, he having developed this class of business in the Spindle Top oil field near Beaumont.

MR. ERNEST A. EDKINS, chairman of the Commercial Section of the National Electric Light Association, has returned to Chicago from New York City, where he attended the first meeting of the new executive committee of the Commercial Section. A very enthusiastic meeting was held, attended by nearly every one of the 18 members, and considerable work attendant upon commencing the year's activities was accomplished. The plans of the new administration of the Commercial Section are even more comprehensive than those of previous years, and the early start justifies the belief that the Section will have a very profitable year. The personnel of nearly all of the committees has been completed and in a number of instances meetings have already been held and committee work is in active progress. Mr. Edkins stated that the establishment of a Commercial Section staff

E. A. Edkins.

at the headquarters of the Association will relieve the standing committees of a large amount of detail work and enable the members to spend more of their time on constructive plans and supervision. The staff will also compile and maintain comprehensive general information and data files covering practically every phase of the industry, to be available to members of the Association at large. Mr. Edkins, who is manager of the Commonwealth Edison Company's Adams Street Electric Shop, is very optimistic over the outlook for the year's work of the Commercial Section, and under his able direction much of present and future worth will undoubtedly be accomplished.

OBITUARY.

MR. HAROLD LOMAS, for over 13 years a member of the sales department of the Crocker-Wheeler Company, Ampere, N. J., was killed on July 1 in the British drive at Friecourt, France. Mr. Lomas served the Crocker-Wheeler Company as manager of its Denver office and also as manager of its Baltimore office.

MR. THOMAS D. WATSON, who was manager of the New York office of the Trumbull Electric Manufacturing Company, of Plainville, Conn., for the past 14 years, died August 16 at his home in Westfield, N. J. He had been ill for eight months, during which time he was not active in business. Mr. Watson had a host of friends in all branches of the electrical industry. He leaves a widow and three children.

MR. CHARLES FFRENCH, well known for many years in the electrical industry, died on Thursday, August 17, at the Polyclinic Hospital, New York City, as the result of injuries suffered in a street car accident on Saturday, August 12. At the time of the accident Mr. Ffrench was passing through New York on his way to his home in Chicago. He was accompanied by his daughter, Florence, and as he turned to assist her to alight he was thrown under the car. He was so seriously injured that amputation of the right leg was made necessary, and Mr. Ffrench did not survive the shock of the operation. Charles Ffrench was born in Dublin, Ireland, 55 years ago. He was graduated from the Jesuit College, Dublin, and came to this country when a young man. He was foreign representative of the ELECTRICAL REVIEW of New York, with offices in London, before coming to this country, and after making his residence in Chicago was the western representative of this publication for several years. Sixteen years ago Mr. Ffrench became owner and publisher of the *Musical Leader and Concert Goer*. He was a man of great physical force, a business man of the most modern type and of the greatest integrity, and took a great interest in professional and civic affairs. He was a past president of the Irish Fellowship Club, of Chicago, the vice-president of the Medievalistic Club, of Chicago, and a member of the Press Club, Chicago Athletic Club, South Shore Country Club, Chicago, and the Lotos Club, New York. At the time of his death he was a trustee of the Board of Education of the City of Chicago, being one of Mayor Thompson's most recent and most popular appointees. During his short period of incumbency as a member of the Board of Education of Chicago, he had vigorously and conscientiously prosecuted every opportunity for service, and had endeared himself to the entire teaching fraternity by his stalwart and manful efforts in behalf of the teachers and the pupils in their care. Big in stature, he was big in every attribute making up the characteristics of a whole-souled, genuine man. He numbered his friends and acquaintances in hosts, and his death brought out a remarkable tribute from people in every station of life in every part of the world. He was buried from St. Thomas' Church, Chicago, where solemn requiem mass was conducted by his close friend, the Rev. Father Shannon, who delivered the eulogy. Mr. Ffrench is survived by his try. Mr. Ffrench is survived by his widow, Florence B. Ffrench; Charles, Jr., Jasper, and four daughters, the Misses Clara, Evelyn, Josephine and Florence.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

BELFAST, ME.—The Central Maine Power Company, of Augusta, has set poles from this town to Brooks to connect its main generating plant with the Penobscot Bay Electric Company's plant in East Belfast. The latter company is a subsidiary of the Central Maine Power Company. The new line is of 33,000 volts capacity. The Central Maine recently bought the line between Bath and Brunswick and has transmission lines extending thence over the central part of the state. Two lines are projected.

EAST CORINTH, ME.—Plans are being made by the Bangor Railway & Electric Company for the erection of a substation in this city. The station will be used for the extension of the company's lighting and power service in this vicinity.

RUMFORD, ME.—A cofferdam to enable excavation for wheel pits and tunnel entrances in connection with the hydroelectric development extension of the Rumford Falls Power Company is now in process of construction by the Cummings Construction Company. The entire work will require about two years.

KEENE, N. H.—The Marlboro (N. H.) Electric Light, Heat & Power Company has sold its plant and business to the Ashuelot Gas & Electric Company, of this city.

NASHUA, N. H.—The city of Nashua has closed a seven-year contract with the Nashua Light, Heat & Power Company for street lighting with type C Mazda lamps. About $3,000 will be saved the city annually as compared with the previous contract. The company is a subsidiary of the Manchester Traction, Light & Power Company.

SWANTON, VT.—This town has voted to extend its municipal light plant by developing a water power at High Gate by the installation of a 1,000-horsepower turbine, at an approximate cost of $55,000. A station will be built at the foot of a rapids and a penstock will be constructed through a ledge. This work will cost about $15,000, making a total of about $70,000.

AMESBURG, MASS.—The Merrimack Valley Buildings & Power Company proposes to develop water power in this town, erecting a power station with a penstock running under the street at Main and Friend Streets.

GREAT BARRINGTON, MASS.—Since the acquisition of the local electric plant by Boston interests over 50 houses in this section have been wired. A new power line will be built to Hartsville, Lake Buel, New Marlboro and Southfield. The company has greatly improved its grounds and will erect illuminated signs on its buildings and on Main Street.

LENOX, MASS.—The Lenox Electric Light Company, controlled by C. D. Parker & Company, of Boston, will spend about $30,000 in rebuilding the local electric-lighting system.

NEWBERRYPORT, MASS.—A contract for street lighting has been awarded to the Newberryport Gas & Electric Company and new lighting units will be installed to replace the old equipment. A white-way system in the business district and 63 new units in the residence district will be installed.

SALEM, MASS.—The Salem Electric Lighting Company has been granted permission to install conduit in Chestnut, Flint and Essex Streets for the transmission line the company is building to Malden.

BRISTOL, CONN.—The Stone & Webster Engineering Corporation plans to install new material, with heavier insulators, on the high-tension steel tower line between this city and Falls Village.

HARTFORD, CONN. — The Hartford Electric Light Company will install, in a few months, a 10,000-kilowatt turbogenerator at its Dutch Point station. The capacity of the station is now 20,000 kilowatts, a generator of 6,000 kilowatts rating being the largest of the seven installed.

HARTFORD, CONN.—The Connecticut Public Utilities Commission has granted the petition of the New Haven Railroad Company, which asked approval of a loan of $100,000 to the Housatonic Power Company to enable the latter to improve its service by the installation of new equipment costing in all $275,000, the major part of which the power company proposes to meet out of current income. The loan is to enable the company to provide better service at a prospective profit without proportionate expenses.

NEW LONDON, CONN.—The New London Ship & Engine Company is erecting a power station at Groton to generate electricity for operating its shop and foundry. The station will be of brick concrete, 64 by 57 feet, and four 360-horsepower Diesel engines will be installed in connection with the generators. The company now buys energy from the Groton municipal plant, and it is proposed to continue this supply. The company already has a small generating plant in its pipe shop. This apparatus will be placed in the new station, where the new apparatus will also be installed.

BROOKLYN, N. Y.—Commissioner Williams of the Department of Water, Gas & Electricity has recommended an appropriation of $300,000 for the erection of a municipal plant for the distribution of Brooklyn-Edison energy to police stations, schools and other municipal buildings.

DEPOSIT, N. Y.—The Deposit Electric Company, operating in the villages of Deposit and Hancock, has been authorized by the Public Service Commission to extend its service to the town of Tomkins in accordance with the terms of a franchise recently granted by the town authorities.

GOUVERNEUR, N. Y.—Negotiations are being completed for the merger of the Oswegatchie Light & Power Company, of this city, with the Aluminum Company of America. The local company is the only concern of its kind doing business on a large scale in this section that is not owned by the Aluminum Company. Energy is furnished for lighting and power in this city and the town of Antwerp. The company controls waterpower sites estimated to have a capacity of 10,000 horsepower.

PERRYSBURG, N. Y.—The Gowanda Light & Power Company and the Silver Creek Electric Company will build transmission lines to this city for the purpose of supplying energy for light and power.

RANSOMVILLE, N. Y.—The Lewiston and Lake Ontario Power Company has been granted a franchise to construct and operate an electric-lighting system here.

KEARNY, N. J.—The Woburn Degreasing Company will build a new power house at its plant on the Newark Turnpike.

PLAINFIELD, N. J.—The Ranger Construction Company, of Holyoke, Mass., has secured the contract for the erection of a power plant for the Bosch Magneto Company, of this city.

HARWOOD, PA.—The Harwood Electric Company is planning to make additions to its power plant. The Schofield Engineering Company, of Philadelphia, is doing the engineering work.

PHILADELPHIA, PA.—D. M. Ellis will build a new brick and concrete boiler plant on Snyder Avenue.

HUNTINGTON, W. VA.—The City Commissioners have awarded the contract for installation of the white-way lighting system to the Emmons-Hawkins Hardware Company, of this city, on its bid of $13,986.

CARY, N. C.—The city will issue $10,000 in bonds for the construction of a transmission line from the town of Method to this city and for a local distribution system. Energy will be secured from the Southern Power Company.

LUMBERTON, S. C.—The city is planning to expend $5,000 to complete changes in the electric-lighting and water plant.

DUE WEST, S. C.—The Due West Water, Light & Power Company has been chartered with a capital of $15,000 by J. R. Bell, S. A. Pressly and O. Y. Brownlee, and will furnish electric service here.

ATLANTA, GA.—The Etowah Milling & Power Company has been incorporated in Georgia, with headquarters at Atlanta. The capitalization is $500,000. The company controls a power site on the Etowah River, near Gainesville, Ga. Officers of the company state that there are gold deposits on the company's holdings which can be reduced by electrometallurgical methods. John P. Given is president and A. H. Malaney is chief engineer.

LA GRANGE, GA.—The city has authorized the issuance of $48,000 in bonds for improvements to the electric-lighting and water systems.

MILLEDGEVILLE, GA.—The Oconee River Mills contemplates the installation of a 300-kilowatt generator direct connected to a steam engine.

METTER, GA.—The city will install an electric-lighting plant and distributon system, at a cost of about $8,500. W. M. Crook, Macon, Ga., is engineer.

PENSACOLA, FLA.—A three-year lighting contract with the Pensacola Electric Company was authorized at a recent meeting of the City Commissioners.

RUSKIN, FLA.—Ruskin College is planning to install a private electric plant. A. D. Miller, secretary of the college, is in charge of plans.

ST. AUGUSTINE, FLA.—The purchase of the local plant of St. John's Electric Company by J. I. Mange, of New York City, has been completed. The plans of the new owner have not been made known, but improvements are anticipated.

NORTH CENTRAL STATES.

BALTIC, O.—A franchise has been granted to the Sugar Creek Light & Power Company for the installation and operation of an electric-lighting plant here.

CINCINNATI, O.—The Union Gas & Electric Company has offered to maintain boulevard lights in a district covering the center of the city at a cost to the city of $60 a year. Details of the installation have not yet been arranged, the maintenance cost being the first matter to be settled. It is believed that the offer will be accepted, and that the Council will formally approve it.

CINCINNATI, O.—Theis & Theis, Dayton, O., have been selected as the architects and contractors for the construction of a $200,000 building for a Catholic young men's and boys' home here. A power plant for the generation of electricity and for steam-heating purposes will be included, as well as an up-to-date system of electrical illumination and other service throughout the building.

LONDON, O.—Bonds in the sum of $25,000 have been voted for establishment of a municipal electric-lighting plant.

LORAIN, O.—The Lorain Electric Company is preparing plans for improvements estimated to cost $250,000. Among those contemplated is the installation of a 6,250-kilowatt turbogenerator with auxiliary equipment.

VENEDOCIA, O.—A proposal has been submitted to this city by the Northwestern Ohio Light Company, of Van Wert, for furnishing electric service.

FAIRMOUNT, IND.—A contract between the Marion (Ind.) Light & Heating Company and this city for supplying energy for light and power here has been approved by the Public Service Commission.

FORT WAYNE, IND.—An ornamental lighting system is being considered for St. Joe Boulevard. O. E. Richards is interested in the plan.

WHITESTOWN, IND.—A company, in which Charles Goodwin is interested, is being organized to secure electric service here.

GIBSON CITY, ILL.—Mellulsh & Broyhill, consulting engineers, of Bloomington,

Ill., have been engaged by the City Council to prepare plans for a proposed municipal electric-lighting plant.

BAY CITY, MICH.—An ornamental lighting system, estimated to cost $10,000, will be installed by the municipal electric light department, of which W. H. Fitzhugh is superintendent.

LANSING, MICH.—B. E. Parks & Son, engineers, of Grand Rapids, are preparing specifications for a new power plant for the W. K. Prudden Company, of this city.

MILWAUKEE, WIS.—The Commissioner of Public Works has awarded contracts aggregating $200,000 for the construction of the municipal electric-lighting plant. Contracts were awarded to the American Steel & Wire Company for $43,230, to the Simplex Wire & Cable Company for $17,600, to the Hazard Manufacturing Company for $10,286, and to the Safety Insulated Wire & Cable Company for $119,240.

ODANAH, WIS.—D. U. Parkinson is making arrangements for the installation of an electric-lighting plant and a telephone system in this city.

PLATTEVILLE, WIS.—There is much dissatisfaction here at the action of the City Council, which voted to discontinue the electric arches on Main Street. The Council claims the arches are out of date, but has made no provision for lighting the business section.

SHEBOYGAN, WIS.—Announcement has been made of the purchase of the property of the Sheboygan Railway & Electric Company by the American Public Utilities Company, of Grand Rapids, Mich. The plant includes a street-railway line in Sheboygan, electric light and power plant in Sheboygan, and interurban lines from Sheboygan to Sheboygan Falls, Plymouth and Elkhart Lake. The American Public Utilities Company is now building a dam on the Chippewa River at Wissota, near Chippewa Falls, where 45,000 horsepower will be developed.

APPLETON, MINN.—The municipal electric-lighting plant has been sold to the Otter Tail Power Company, of Fergus Falls, for a consideration of $9,000.

DULUTH, MINN.—Plans for extending its transmission lines from Twin Ports to Hibbing are being made by the Great Northern Power Company, of this city. The extension is for the purpose of supplying energy for light and power into Mesaba Range district, and will cost approximately $200,000, according to preliminary estimates. The line will be about 83 miles long when completed and will be designed to transmit 10,000 horsepower. The total capacity of the company's Duluth plant is 52,000 horsepower, of which about 30,000 horsepower is being sold. New steam equipment will be installed at Virginia which will double the capacity of the plant there, which will be used for emergency purposes.

FERGUS FALLS, MINN.—The city is considering plans for the disposal of the municipal electric-lighting plant to the Otter Tail Power Company, of this city.

CLEARFIELD, IOWA.—At a recent election a 25-year electric-lighting franchise was granted to the Clearfield Electric Company. David Fisher & Company have an option on the former company's plant and propose to change the supply from direct to alternating current, to be furnished from the plant at Mount Ayr.

TORONTO, IOWA.—The Council has accepted the proposition of the Iowa Electric Company, of Cedar Rapids, and will submit the matter of granting the company an electric-lighting franchise to the voters.

BROWNING, MO.—The Browning-Purdin Electric Company has been incorporated with a capital of $14,000 by P. W. Harry and L. W. Markham and will generate electrical energy for light and power in the towns of Browning and Purdin.

KANSAS CITY, MO.—The Park Board has adopted a plan to install 175 electric lamps in Swope Park. Bids will be asked at once, to be opened August 30.

KANSAS CITY, MO.—The Ford Motor Company is installing at its local assembly plant, two 250 and one 75-kilowatt generators, a 400-horsepower tandem compound Corliss and a 150-horsepower Uniflow engine. The energy generated will be used for lighting, elevators and motors in the assembly plant.

KANSAS CITY, MO.—The Kansas City Light & Power Company recently filed the final brief with the Missouri Public Service Commission in the matter of the adjustment of rates, following the filing of an amended brief by the City Counselor of Kansas City. The company states, in the brief, that the separation of the railways and light company will necessitate the expenditure of some $5,000,000 in erecting a modern power plant adequate for future requirements, and extension of conduits and pole lines into the city and country tributary to Kansas City. The statement gives support to the recent reports that the company may very soon complete its plans for a large central station, probably outside the city, capable of supplying not only Kansas City, but many towns and large industries.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 4-7. Secretary, G. C. Holberton, San Francisco, Cal.

Pennsylvania Electric Association, Annual convention, Eagles Mere, Pa., September 5-8. Secretary, H. M. Stine, 211 Locust Street, Harrisburg, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Seattle, Wash., September 5-8. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York City.

Northwest Electric Light and Power Association. Annual convention, Hotel Washington, Seattle, Wash., September 6-9. Secretary, W. G. Letson, Jim Creek Water, Light & Power Company, Arlington, Wash.

Indiana Electric Light Association. Annual convention, Anthony Hotel, Fort Wayne, Ind., September 12-14. Secretary, Thomas Donohue, Lafayette, Ind.

Illuminating Engineering Society. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., September 18-20. Assistant secretary, C. D. Fawcett, 29 West Thirty-ninth Street, New York City.

Association of Iron and Steel Electrical Engineers. Annual convention, Chicago, Ill., September 18-22. Secretary, W. O. Oschmann, Oliver Steel & Foundry Company, Pittsburgh, Pa.

American Electrochemical Society. Semi-annual meeting, New York City, September 28-30. Secretary, J. W. Richards, South Bethlehem, Pa.

Electrical Supply Jobbers Association. Quarterly meeting, Hotel Statler, Cleveland, O., October 10-12. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

New England Section, N. E. L. A. Annual convention, Pittsfield, Mass., October 17-20. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Jovian Order. Annual convention, Indianapolis, Ind., October 18-20. Secretary, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 19-20. Secretary, R. H. Starrett, 195 Broadway, New York City.

BELPRE, KANS.—The city has voted to issue $10,000 in bonds, the proceeds to be used for the erection of an electric distribution system.

FORT SCOTT, KANS.—Improvements costing $20,000 will be made to the local electric-lighting plant. New equipment to be installed will include a cooling tower and condensing apparatus. The property is owned by the Light & Development Company of St. Louis and the work of improving the plant will be commenced this month.

HURON, KANS.—Plans are being made for the erection of a transmission line to secure energy from the Atchison (Kans.) Railway & Light Company for street lighting in this city.

HUTCHINSON, KANS. — The United Water, Gas & Electric Company is planning a number of extensions to its transmission system. Right of way is being secured for a power line from Nickerson to Sterling.

OLPE, KANS.—Ways and means are being considered to secure electric-lighting service in this city.

WICHITA, KANS.—Plans are being formed for an extension of the downtown white-way system.

WAHOO, NEB.—Bids will be received August 30 for furnishing labor and machinery for extensions to the electric-lighting and water systems, estimated to cost $10,000.

GARRETSON, S. D.—On August 29 voters here will consider a proposition to expend $18,000 for additional machinery for the city electric-lighting plant. The demand for electricity has been so much greater than anticipated that the present plant has been found inadequate.

BERTHOLD, N. D.—The Northern States Power Company has applied for an electric-lighting franchise in Berthold. If the franchise is granted the company will erect a transmission line from Burlington to Berthold and will furnish energy for light and power to the towns of Des Lacs and Lone Tree and the rural community in that district.

DOUGLAS, N. D.—A franchise has been granted to William Johnson for the construction and operation of an electric-lighting plant here.

SOUTH CENTRAL STATES.

COVINGTON, KY.—The Board of Education will receive bids until September 11 for the construction of a new high-school building, including electrical equipment, under plans and specifications prepared by Architects Weber, Werner & Adkins, Cincinnati, O.

FLEMINGSBURG, KY.—Instead of selling the local plant, as had been contemplated, the Flemingsburg Light & Ice Company will call for an additional $8,000 of stock authorized and proceed to install new alternating-current machinery, as projected some time ago.

LEXINGTON, KY.—A new system of street lighting is expected to be installed here in connection with the new franchise sold to the Lexington Utilities Company. Dr. M. R. Maltbie, of New York, the city administration and the company are studying plans for the changes to be made.

BRISTOL, TENN.—Fred Dulaney and others are seeking a franchise for delivery of electrical energy for light and power to this city. They are developing hydroelectric power on the Holston River. It is intimated that interurban electric railways are to be put in operation.

CARTHAGE, TENN.—A franchise to construct and maintain an electric-lighting system has been granted to W. P. Eaves.

ELIZABETHTON, TENN. — Four 150-horsepower, 440-volt, three-phase, 60-cycle induction motors and a 250 to 400-kilowatt non-condensing steam turbine are to be purchased by William Whiting.

HARTSVILLE, TENN.—A franchise has been granted by the city to E. W. Rugg, Cincinnati, O., and others to build an electric-lighting plant.

MEMPHIS, TENN.—The Van Vleet-Mansfield Drug Company, which will erect a plant for the manufacture of drugs, will install an isolated lighting and power plant. C. F. Pfeil is architect.

SHELBYVILLE, TENN.—S. P. Kirkpatrick is in the market for electrical fixtures for an $8,000 church.

QUITMAN, MISS.—The trustees of the Agricultural High School have let a contract to W. H. Patten & Son, of Shubuta, Miss., to construct an electric-lighting plant and water system.

ATKINS, ARK.—The Arkansas Light & Power Company is making negotiations for the purchase of the local electric-lighting franchise.

FT. SMITH, ARK.—The City Commission is preparing plans for the establishment of a municipal electric-lighting plant.

HARRISBURG, ARK.—The Harrisburg Electric Light & Power Company is planning to erect an addition to its power plant and install generating equipment to furnish power for industrial plants.

LAFAYETTE, LA.—The City Council is considering the installation of new engines in the municipal electric-lighting plant at an outlay of about $18,000.

EDMOND, OKLA.—Bonds on the sum of $9,000 have been voted for extensions and improvements to the municipal electric-lighting plant.

WAYNOKA, OKLA.—At an election to be held August 31 the proposition to issue $50,000 in bonds for improvements to the electric-lighting and water plants will be considered by the voters.

WOODWARD, OKLA.—At an election to be held soon the voters will consider the issuance of $12,500 water works and $2,500 electrical improvement bonds.

BELLVILLE, TEX.—The Bellville Ice, Light & Power Company has been incorporated with a capital of $30,000 by H. Hamilton, L. A. Machemehl and C. F. Hellmuth and will furnish electric service here.

BLANKET, TEX.—This city now has electric lights, service being furnished by the Texas Power & Light Company by means of a new transmission line from Brownwood to Comanche via Blanket.

DENTON, TEX.—Work on the white way about the courthouse square on East Hickory Street to the railroad station and West Oak Street to Fry Street has been started.

MARLIN, TEX.—The Commercial Club has appointed a special committee for the purpose of preparing plans for a white-way system in the business district here.

PORT ARTHUR, TEX.—The state attorney-general's department has approved an issue of $34,000 bonds, the proceeds to be used in installing an electric fire-alarm system here.

TAHOKA, TEX.—E. L. Howard has been granted a franchise to install and operate an electric-lighting plant in this city.

WOLFE CITY, TEX.—The Texas Power & Light Company has purchased the local electric-lighting plant and will serve this place by means of a high-tension transmission line.

WESTERN STATES.

DENTON, MONT.—An electric-lighting plant will be installed here by G. Von Egeler, of Watertown, S. D.

ROUNDUP, MONT.—At a meeting of the County Commissioners the Roundup Coal Company presented a proposition to furnish energy for the ornamental street lamps at five cents per kilowatt-hour. As this is less expensive than the present system, the offer was accepted and a contract ordered drawn up.

KINGMAN, ARIZ.—Articles of incorporation have been filed for the Wallapai Lighting & Power Company, with a capital stock of $50,000, by Robert Roe, A. Fay, A. L. Cox and R. C. Van Denberg.

TOMBSTONE, ARIZ.—Great damage has been done to equipment of the Arizona Power Company, especially southeast of Prescott, where recent storms were very heavy. Lightning almost wrecked the plant of the company on Fossil Creek.

WILLIAMS, ARIZ.—It is understood that E. P. Ripley, president of the Atchison, Topeka & Santa Fe Railroad, and his associates have taken over the Grand Canyon reservoir and hydroelectric project. Plans for this enterprise involve the building of a dam across one of the laterals of the Grand Canyon and the storage of water for operating one of the largest hydroelectric plants in this country, including the irrigation of more than 200,000 acres of land. Electric power transmission lines are expected to be constructed to mining districts, towns and industrial centers within a radius of 200 miles of the generating plant. The dam will be the highest in the world and the capacity of the water storage reservoir will be larger than that formed by the famous Assuan dam across the Nile in Africa. Some of the engineers are already on the ground and others will arrive in a few days. It is understood that permanent surveys will be finished and construction work started before the middle of November.

TWIN FALLS, IDAHO.—The City Council has signed a 10-year contract for street lighting with the Idaho Power Company. A new street-lighting system, including 58 new units, will be installed, the cost being estimated at $10,000.

NORTHPORT, WASH.—C. A. Coffin, who recently secured a 35-year electric-lighting and water franchise in this city, estimates that the cost of installation will be about $50,000. Construction will begin as soon as equipment can be obtained.

SEATTLE, WASH.—Construction of the $40,000 light and fog signal station to be established at or near Kellett Bluff, Henry Island, or at a point on San Juan Island, is to begin immediately, according to advices received from Washington, D. C.

SPOKANE, WASH.—Property owners have petitioned for the extension of the lighting system on Riverside Street from Washington to Cedar. The cost of the work is estimated at $80,000.

DUNSMUIR, CAL.—Arrangements are being made by the California-Oregon Power Company for the extension of its service from Sisson to McCloud.

FULLERTON, CAL.—The Board of Trade has under consideration the installation of a system of ornamental lamps on Spadra Avenue.

LOS ANGELES, CAL.—City Electrician R. H. Manahan recently announced that a revised electrical code would be submitted shortly to the Board of Public Works. It will provide for the uniform use of conduits for all interior electric wiring.

LOS ANGELES, CAL.—Much testimony was submitted at the hearing before the State Railroad Commission on the application for permission to proceed with work by the Fontana Power Company, which proposes to establish a hydroelectric plant and distribution system in the Fontana Lands district, San Bernardino Valley. The Commission took the matter under advisement.

OAKLAND, CAL.—An announcement has been made by S. T. Mather, Assistant Secretary of the Interior, that the United States Government will erect a 750-horsepower electric plant in the Yosemite Valley, to cost about $100,000.

REDDING, CAL.—The machinery of the Green Horn Copper Company will soon be operated electrically, the power being supplied from the Crystal Creek plant near French Gulch.

REDDING, CAL.—The Board of Trustees is taking bids for the installation of a street-lighting system in accordance with plans and specifications on file with the city clerk.

RIVERSIDE, CAL.—The Southern California Edison Company has notified the Board of Public Utilities of its intention of constructing a new transmission line to provide this city with additional energy.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has let contracts for raising the height of its famous dam at Lake Spaulding from 225 feet to 260 feet, thus increasing by almost 50 per cent the storage capacity of Lake Spaulding. The dam was completed to its present height of 225 feet in 1913 and at the same time the initial hydroelectric installation of 33,000 horsepower was placed in service. Two more generating stations are now in course of erection and will add another 33,000 horsepower to the generating capacity. The increase in the height of the dam will guarantee an ample supply of water at all times for the hydroelectric stations and will bring up the capacity of the storage reservoir from 43,600 acre-feet to 63,900 acre-feet. The company also has appropriated $250,000 for the construction of tunnels and other equipment necessary to supply the Newcastle territory with water for irrigation.

Proposals

ELECTRIC MOTOR CONTROL.—Sealed bids will be received until September 5 by G. J. Ries, County Auditor, St. Paul, Minn., for an electric motor control for deep well at the boys' farm at Highwood.

MOTORS.—Sealed bids will be received until September 1 by E. E. Denniston, City Clerk, Hudson, Wis., for constructing an artesian well and pumping station and furnishing pumps and motors.

ELECTRIC WIRING AND FIXTURES.—Sealed bids will be received until September 1 at the office of the clerk of the Board of Education, 20 West Wood Street, Youngstown, O., for furnishing the labor and material for installing the electric wiring and electric fixtures in the following school buildings: West Side (two buildings), Steelton, Hill Side, Haselton, Market, Fairmont, Elm, Parmelee, Covington, Shehy, Oak and Delason buildings. W. N. Ashbaugh, Director of Schools.

HEATING AND POWER PLANT.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until September 30 for installing generator sets furnished by the government, and furnishing and installing boilers, condensers, pumps, motors, switchboard, equipment, piping, wiring, lighting, etc., for the heating and power plant at the Naval Torpedo Station, Puget Sound, Wash. Plans and specifications may be obtained on application to the Bureau of Yards and Docks or to the Commandant, Navy Yard, Bremerton, Wash.

Financial Notes

The Salmon River Power Company is asking for tenders until August 29 through the Columbia Trust Company for sufficient of its first-mortgage five-per-cent bonds to exhaust $38,960 now available for the sinking fund of this issue.

The Portland Railway, Light & Power Company had a deficit of $114,239.23 as a result of its operations during the year ending June 30, according to the annual report filed with the Public Service Commission. At the beginning of the fiscal year the corporation had a surplus of $575,442.39 and at its close the surplus was $461,203.16.

The California Railroad Commission has issued an order authorizing the California Telephone & Light Company to issue $25,000 face value of its first-mortgage six-per-cent bonds maturing April 1, 1943, to net the company no less than 94 per cent of par, and the proceeds to refund outstanding obligations, to pay for extensions, additions and improvements.

It is estimated that earnings on the common stock of Dominion Power & Transmission Company, now on a quarterly dividend basis of one per cent, will show ten per cent for the current year. The stock is now selling around 65. Earnings of the company have shown a steady increase from $761,170 in 1904 to $2,363,956 in 1915. At the rate at which earnings are now increasing men close to the company expect that it will not be long until the dividend rate on the common stock is advanced or an extra dividend is paid.

For the fiscal year ended June 30 gross of Adirondack Electric Power Corporation was $1,447,977, an increase of $226,473 over the preceeding year with net of $650,057, a gain of $240,193. After providing for interest charges and rentals the surplus was $393,190, compared with $155,174 for the year ended June 30, 1915. Earnings for the fiscal year were at a rate of about 15 per cent on the six-per-cent preferred stock which will become cumulative next December. After providing for the preferred dividends there was about 2.5 per cent left for the common stock. In June, 1916, gross increased $11,336 while operating expenses and taxes were more than $9,000 less than for June, 1915, thus resulting in a gain of almost 50 per cent in net over June, 1915. The cause for the large decrease in operating expenses is found in the fact that last summer the company was compelled to purchase large amounts of steam generating power while this year there has been abundant water for the hydroelectric plants.

Assents of more than 75 per cent of the stock of Lincoln Gas & Electric Light Company of the preferred stock of the Electric Bond Deposit Company and of the capital stock of Montgomery Light & Water Power Company to the proposed exchange of stocks of Cities Service Company for these issues have been received and the plan for these exchanges has been declared operative as of August 1. Lincoln Gas & Electric Light Company does the entire gas business of Lincoln, Neb., and also an electric light and power service in Lincoln and adjoining communities. The company has 3,000 kilowatts generating capacity and 2,000 kilowatts additional will be installed the coming fall. Montgomery Light & Water Power Company supplies electric light and power and gas in Montgomery, Ala., owns a hydroelectric plant on the Tallapoosa River and a modern gas plant. Electric Bond Deposit Company is an investment holding company owning practically all the bonds, all the preferred, and a large part of the common stock of the Ozark Power & Water Company, which

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 21	Aug. 14
American Tel. & Tel. (New York)	131¾	130⅛
Commonwealth Edison (Chicago)	141	142
Edison Electric Illuminating (Boston)	237	...
Electric Storage Battery common (Philadelphia)	67	67½
Electric Storage Battery preferred (Philadelphia)	67	67½
General Electric (New York)	170¼	168
Kings County Electric (New York)	...	127
Massachusetts Electric common (Boston)	7½	7¼
Massachusetts Electric preferred (Boston)	42	41½
National Carbon common (Chicago)	181	178
National Carbon preferred (Chicago)	121¾	121¾
New England Telephone (Boston)	127	130
Philadelphia Electric (Philadelphia)	28⅜	29
Postal Telegraph & Cables common (New York)	...	...
Postal Telegraph & Cables preferred (New York)	...	...
Western Union (New York)	96	93½
Westinghouse common (New York)	60⅝	58¼
Westinghouse preferred (New York)	...	68

owns a hydroelectric plant on the White River near Bransom, Mo. Earnings of the Ozark Power & Water Company for the 12 months ended June 30 were double those of the preceding 12 months.

Dividends.

	Term	Rate	Payable
Cent. Miss. Val. Elec., pf.	Q	$1.50	Sept. 1
Cities Service, com.	M	0.5 %	Oct. 1
Cities Service, pf.	M	0.5 %	Oct. 1
Mid. West Util., pf.	Q	1.5 %	Sept. 1
No. Tex. Elec., Com.	Q	1 %	Sept. 1
No. Tex. Elec., pf.	S	3 %	Sept. 1
Roch. Ry. & Lt., pf.	Q	1.25%	Sept. 1
Southwest. Pow. & Lt., pf.	Q	1.75%	Sept. 1

Reports of Earnings.

VERMONT POWER & MANUFACTURING.

Vermont Power & Manufacturing Company reported for the four months ended April 30, 1916, as follows:

	1916	1915	Changes
Gross earnings	$21,183	$19,834	Inc. $1,348
Net after taxes	13,278	13,016	Inc. 262
Surplus after chgs.	9,111	8,850	Inc. 262

CITIES SERVICE.

Cities Service Company reported for the twelve months ending July 31, 1916, as follows:

	1916	1915
Gross earnings	$6,833,862	$4,003,722
Expenses	209,503	153,578
Net earnings	6,624,359	3,850,143
Interest on notes and debentures	461,116	490,000
Net to stock	6,163,243	3,360,143
Dividends, preferred stock	1,845,535	1,593,996
Net to common stock	4,317,708	1,766,147
Dividends, common stock	90,687	
Net to surplus and reserve	4,227,021	1,766,147

New Incorporations

CAMBRIDGE, MASS.—Clark & Mills Electric Company. Capital, $50,000. Incorporators: Charles W. Mills and Arthur D. Perry.

CANTON, O.—Fornes-Walters Electric Company. Capital, $10,000. Incorporators: G. F. Fornes, W. H. Burgener, R. D. Walters and others.

COLUMBUS, O.—Ohio Storage Battery Company. Capital, $20,000. Incorporators: G. C. Lee, Sr., G. C. Lee., Jr., J. C. Langley, J. W. Collins and J. A. Weston.

MEMPHIS, TENN.—Memphis Armature Company. Capital $3,500. Incorporators: J. W. Marshall, T. C. Oberst, J. W. Wadlington, R. F. Hodgkin and W. P. South.

NEW YORK, N. Y.—Relco. Capital $10,000. Manufactuer electric bulbs, etc. Incorporators: F. J. Rooney and J. J. Rooney, of Hoboken, N. J., and J. C. Jackson, of New York City.

CHICAGO, ILL.—Grand Electric Company. Capital, $4,000. Manufacture and deal in electric appliances and devices. Incorporators: A. L. Hansen, J. L. Reque and M. S. Hansen.

WILMINGTON, DEL.—Spokane Heat, Light & Power Securities Company. Capital, $2,250,000. Deal in stocks, bonds and securities. Incorporators: H. E. Latter, N. P. Coffin and C. M. Egner.

PHILADELPHIA, PA.—Fleer Electric & Manufacturing Company. Capital, $100,000. Deal in dynamos and electrical machinery of all kinds. Incorporators: G. V. Reilly, L. H. Gunther and S. B. Howard.

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 21,832. ELECTRIC TRAMWAY.—Supplementing confidential circular No. 881, an American consular officer in Russia has forwarded to the Bureau a copy of the specification and estimates covering the proposed tramway in his district. A copy of the specification, etc., may be inspected at the Bureau or its district offices. (Refer to file No. 77,951.)

NO. 21,843. ELECTRIC STOVE ACCESSORIES.—A manufacturer of electric cooking stoves in Norway informs an American consular officer that he desires to be placed in communication with American manufacturers of electric cooking stove accessories.

No. 21,972. ELECTRIC GLOBES.—A man in the United States writes that he has an inquiry from a firm in Japan for the names of manufacturers of tungsten filament electric globes.

NO. 22,009. ELECTRICAL SUPPLIES.—A firm in India writes that it wishes to receive catalogues, etc., from manufacturers of electrical supplies.

NO. 22,046. ELECTRICAL MACHINERY AND SUPPLIES.—An established merchant and electrical engineer from Argentina, who is now in the United States, desires to represent American manufacturers of electrical machinery and supplies.

Electrical Patents Issued August 15, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,194,353. **Car and Electric Coupling.** T. R. Brown, assignor to Westinghouse Air Brake Co., Wilmerding, Pa. Details of electric train line coupling.

1,194,354. **Electrolytic and Saponifying Process for Producing Nitrile Derivatives.** J. E. Bucher, assignor to Nitrogen Products Co., Providence, R. I. Process of producing oxamid.

1,194,357. **Telegraph Transmitter.** A. D. Cardwell, New York, N. Y. Impulse-controlling contacts operated by bank of keys.

1,194,365. **Printing-Telegraph Receiver.** A. F. Dixon, assignor to Western Electric Co., New York, N. Y. Manner of operating punches making perforated record.

1,194,367. **Automatic Telephone-Exchange System.** B. G. Dunham, assignor to Western Electric Co. Details of structure and arrangement of automatic switches.

1,194,371. **Selective Signaling System.** J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. For automatic telephone systems.

1,194,378. **Recording Device.** C. L. Goodrum, assignor to Western Electric Co. For recording traffic on trunks or switches of automatic telephone system.

1,194,386. **Electrical Switch.** B. D. Horton, Detroit, Mich. Of ironclad type; main and branch switches are plunger-operated along with indicator lamp.

1,194,398. **Automatic Water Heater.** H. Langenheim, Pittsburgh, Pa. Gas heater thermoelectrically controlled.

1,194,413. **Electric Fan.** M. Nesseler, Kansas City, Kan. Foldable fan blades and guard.

1,194,429. **Guard for Trolley Wheels.** P. R. Schafer, Brownfield, Pa. Details of structure having cord-controlled fingers overlying trolley wire.

1,194,437. **Carbureter Attachment.** F. McC. Starbuck, Washington, D. C. Fuel volatilized by electric heat.

1,194,438. **Process for Separating Metals.** R. H. Stevens, assignor to United States Smelting, Refining & Mining Co., Portland, Me. Electrolytic processes for separating metals from ores containing cadmium, bismuth, copper, lead, tellurium, arsenic and similar metals.

1,194,439. **Signaling Device for Vehicles.** A. R. Suhner and J. D. Coakley, New York, N. Y. Motor-operated signal moved into and out of casing and lamp-lighted.

1,194,444. **Self-Winding Clock.** W. J. Van Osdel, assignor of one-half to L. Sperling, Chicago, Ill. Gravity actuator electromagnetically reset.

1,194,447 **Switch.** H. Walker and W. L. Kreuscher, Anaheim, Cal. Details of two-point switch having pivoted arm making sliding contact.

1,194,448. **Semaphore.** H. Walker, Anaheim, Cal. Details of electromagnetically operated device.

1,194,451. **Theater Dimmer.** H. J. Wiegand, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Mechanism for operating rheostats independently or together.

1,194,457. **Telephone Receiver.** B. D. Willis, assignor to Automatic Electric Co., Chicago, Ill. Has inductance that is greatest with current below 0.1 ampere.

1,194,458. **Derrick and Hod Signaling System.** H. A. Yates, assignor to the Y & G Electric Fuse & Engineering Co., New Jersey. Comprises selectively operated visible and audible signals.

1,194,470. **Alternating-Current Rectifier.** D. M. Bliss, assignor to T. A. Edison, Inc., West Orange, N. J. Commutating mechanism.

1,194,474. **Combined Spark Plug and Spark Gap.** W. C. Brunke and H. D. Clarke, Omaha, Neb. Details of structure having auxiliary, visible spark-gap.

1,194,480. **Switch Mechanism for Automobile-Lighting Systems.** H. A. Clum, assignor to Clum Mfg. Co., Wauwatosa, Wis. Avoids tampering; operated by insertible key.

1,194,482. **Door Opener.** H. W. Crane, Chicago, Ill. Electric-motor-operated sliding door.

1,194,497. **Battery and Container.** E. A. Hawthorne, Bridgeport, Conn. For portable flashlight.

1,194,500. **Battery-Charging Panel.** A. J. Horton, assignor to Cutler-Hammer Mfg. Co. Arrangement of switches, rheostats, voltmeter connections, etc.

1,194,517. **Photo-Play Orchestral Director.** S. W. Lawton, New York, N. Y. Directing indicator controlled by switches operated in sequence by progress of picture.

1,194,524. **Selective Signaling Means.** J. McFell, Chicago, Ill. Employs key-initiated number signals.

1,194,525. **Electric Signaling Means.** J. McFell. Modification of above.

1,194,537. **Automobile Signaling System.** A. H. Otis, Cleveland Heights, O. Direction and stop-signal control.

1,194,543. **Trolley-Wheel Construction.** J. H. Reese, Butler, Pa. Special structure of harp having lugs to prevent jumping of trolley wire.

1,194,564. **Switching Mechanism.** H. A. Steen, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Potential starter.

1,194,571. **Fire-Alarm System.** F. A. Swan, Cliftondale, Mass. Details of signal box.

1,194,589. **Process of Making Steel Pulleys.** N. Barry, assignor to Barry Co., Muscatine, Iowa. Sheet-metal parts are electrically welded.

1,194,594. **Automatic Railway Gate.** J. Briggs, assignor of one-half to W. T. Gunn, Hoopeston, Ill. Train-controlled crossing gate.

1,194,600. **Signal Box.** F. W. Cole, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Details of alrm-box mechanism.

1,194,606. **Electric Arc Furnace for the Treatment of Gases.** C. O. Dölve, assignor to Nork Hydroelektrisk Kvaelstofaktieselskab, Christiana, Norway. Arrangement of gas openings with relation to magnetically spread flame disk.

1,194,607. **Combined Electric Lighting and Starting Apparatus for Motor Vehicles.** L. Duca and E. Naldini, Turin, Italy. Structure and arrangement of dynamo and starting motor.

1,194,643. **Incandescent Lamp.** H. Kreusler, H. Gerdien, and M. Von Pirani, assignors to Siemens & Halske A. G., Berlin, Germany. Bulb having carbon filament and liquid mercury is enclosed in gas-filled bulb.

1,194,645. **Variable-Speed Electric Motor.** J. C. Lincoln, assignor to Lincoln Co., Cleveland, O. Armature is shiftable axially through field.

1,194,658. **Combination Automobile Lamp.** J. R. Pagin, Valparaiso, Ind. Has two lamps, each having reflector, capable of being separately focused and selectively controlled.

1,194,663. **Combined Electric Stove and Toaster.** G. E. Rinking, Fort Wayne, Ind. Structural details.

1,194,668. **Signaling Device.** C. Schatzle and E. Smith, Palmerton, Pa. For location at roadway crossings and operated by approaching vehicle.

1,194,671. **Repulsion Motor-Generator.** K. Schnetzler, assignor to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland. Has variable, non-inductive resistance in series with stator winding.

1,194,683. **Electrical Regulator.** A. A. Tirrill, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Vibratory-contact field regulator.

1,194,688. **Storage Battery.** T. A. Willard, assignor to Willard Storage Battery Co., Cleveland, O. Structure of jar cover. (See cut, next page.)

1,194,690. **Telephone and Telegraph Pole Construction.** H. E. Adams, Pittsburgh, Pa. Cross arm has grounded sheathing with sliding plates carrying insulators.

1,194,703. **Ignition Device.** J. J. Bottlander, Toledo, O., assignor of one-third each to J. R. Harry and H. C. Cotter. Priming spark-plug.

1,194,713. **Electric Power System for Internal-Combustion Engines.** A. Churchward, assignor to A. B. C. Starter Co., Detroit, Mich. Structure of drive between engine and dynamo.

1,194,714. Railway Signaling System. C. J. Coleman, assignor to Hall Switch & Signal Co., New York, N. Y. Block system with signaling current inductively supplied to rails and inductively controlled.

1,194,715. Railway Signal. J. P. Coleman, assignor to Union Switch & Signal Co., Swissvale, Pa. Details of motor-operated signal arm.

1,194,721. Service-Observing System. H. L. Darrah, assignor to Western Electric Co. Manner of connecting in observing desk with telephone central.

1,194,723. Fire-Alarm Apparatus. D. G. Dee, assignor to Denio General Electric Co., Rochester, N. Y. Combined with central-energy telephone systems.

1,194,747. Insulator. H. R. Kells, New York, N. Y. Special form of cleat.

1,194,758. Signal. D. J. McCarthy, assignor to Union Switch & Signal Co. Arrangement of screens and reflector in light projector.

1,194,765. Telephone Receiver. D. P. Moore, Washington, D. C. Has permanent magnet and coil acting on diaphragm, the coil being adjustable.

1,194,772. Lamp Support. S. Newman and H. R. Bothwell, Cincinnati, O. Lamp at end of telescoping arm secured at other end by ball-and-socket joint.

1,194,778. Electric-Current Modifier. V. Paquit, Stapleton, N. Y. Commutator device for successively supplying current to number of consuming circuits.

1,194,783. Brake System for Moving Vehicles. G. Rennerfelt, assignor of one-half to C. J. Kintner, New York, N. Y. Interrelated control of motor and brakes.

1,194,807. Steam-Motor and Electrical-Generator Combined Efficiency Indicator. R. S. Xenaky, assignor of one-half to F. Gilman, Birmingham, England. Wattmeter has opposed current and potential coils, the former controlled by rheostat regulated according to water consumption.

1,194,808. Temperature-Indicating or Recording System and Appliance. A. Barry, Liverpool, England. Electrical system for transmitting temperature data from a distance.

1,194,818. Separator for Batteries. R. N. Chamberlain, assignor to Gould Storage Battery Co., New York, N. Y. Of treated wood.

1,194,820. Multiplex Radiotelegraph System. E. H. Colpitts, assignor to Western Electric Co. Employs plurality of low-power oscillations of different, high frequencies.

1,194,851. Automatic Telephone System. A. E. Lundell, assignor to Western Electric Co. Arrangement of guarding contacts for electrically operated switch.

1,194,856. Signal Device. J. Mark, Chicago, Ill. For automobiles, to indicate change in speed or direction.

1,194,879. Traveling Electric Sign. V. E. Rumbarger, Dayton, O. Illuminated sign on side of delivery wagon controlled by driver.

1,194,880 and 1,194,881. Meter Adapter. J. Sachs, Hartford, Conn. First patent: For connecting terminal chambers of different forms of meters with service cabinet. Second patent: Sealing means of meter and adapter.

1,194,882. Clip. J. Sachs. Has spring lips for engaging post with expander for holding them open.

1,194,883. Meter-Testing Appliance. J. Sachs. Modified standard fuse cutout block.

1,194,886. Electric Water-Heater. M. Simon, St. Louis, Mo. Arrangement of coils and heater, latter controlled by pressure in former.

1,194,888. Vehicle Signal. J. Spaerer, Newark, N. J. Combined automobile tail light and direction indicator.

1,194,906. Method and Apparatus for Sintering Metal. R. B. Walling, assignor to General Electric Co., Schenectady, N. Y. For sintering rods; contacts with rods made by stationary contact set in water-cooled member and a movable contact floated in mercury and water-cooled.

1,194,911. Time System. J. C. Wilson, Boston, Mass. Time beats electrically transmitted from master to secondary clocks.

1,194,914. Signal. F. W. Wood, assignor to Charles Cory & Son, New York, N. Y. Electric motor drives timing mechanism controlling circuit-governing valve of steam whistle.

1,194,920. Signaling Apparatus for Motor Cars. F. W. Yonge, Tampa, Fla. Switching apparatus for operating signaling disk and lamps and audible alarm.

1,194,923. Alternating-Current Commutator Motor. E. F. Alexanderson, assignor to General Electric Co. Repulsion motor has circuit closed through auxiliary brushes, 90 degrees from main brushes, by inductive winding with magnetic circuit becoming saturated at predetermined voltage.

1,194,928. Clock-Rewinding Device. C. Auer, Fragaria, Wash., assignor of one-fourth to F. Rueth. Electrically driven weight-resetting mechanism.

1,194,929. Electric Light. J. M. Austen and B. J. Lee, Sacramento, Cal. Tiltable lamp structure for mounting on dry-cell casing.

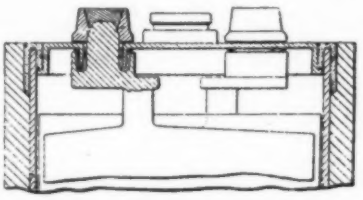
1,194,930. Lamp. J. M. Austen, Sacramento, Cal. Modification of above.

1,194,931. Signal Box. C. E. Avery, assignor to Manhattan Electrical Supply Co., New York, N. Y. Details of built-up operating rotor for single signal-contact couple.

1,194,940. Magnetic Treatment of Metals. F. L. Bishop, Pittsburgh, Pa. To alter molecular structure.

1,194,946. Headlight. F. Buchanan, Syracuse, N. Y. Details of casing, lens, etc.

1,194,957. Insulator. H. H. Cochrane, Butte, Mont. Wooden rod has metal eyes



No. 1,794,688—Storage-Battery Cover.

at ends and surrounded by tubular, petticoated sections of insulation.

1,194,959. Telephone Instrument. A. L. Cotton and J. S. Wicking, assignors of one-third to G. G. Turri, Melbourne, Australia. Transmitter circuit controlled from central.

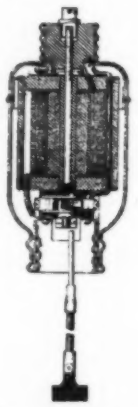
1,194,970. Automatic Controlling System for Electric Generators. A. E. Doman, assignor to Dyneto Electric Co., Elbridge, N. Y. In connection with storage battery; driving clutch controlled by electromagnetic shifting of armature shaft endwise.

1,194,981. Electric Railway Signal. H. J. Faubel and W. Roach, Alliance, O. Semaphore operated by car-wheel-depressed contact.

1,194,986. Illuminating Device. D. T. Finkbeiner, Freeport, Pa. Adapted for placing in phonograph cabinet.

1,195,032. Portable Electric Lamp. E. W. Lamb, Lansing, Mich. Switch structure and mounting.

1,195,060. Mail-Box Alarm. J. G. Menow and H. Meyer, assignors to National Elec-



No. 1,195,137—Reactance Lamp-Dimmer.

tric Mail Box Alarm Co., Santa Rosa, Cal. Closure controlled by deposited matter.

1,195,063. Ignition System. A. L. Moeller, Mishicott, Wis. Structure of distributer.

1,195,079. Electrical Connector Clip. J. G. Peterson, assignor to Manhattan Electrical Supply Co., New York, N. Y. Spring structure for connecting conductor with binding posts.

1,195,088. Direction Indicator. C. A. Reese, Bowling Green, Fla. Arms of image carry lights and are operated by solenoids in body.

1,195,089. Spark Plug. O. Rickmeyer, Milwaukee, Wis. Has automatically cleaned electrodes.

1,195,128. Safety Control System for Elevators. J. C. A. Anderson, Chicago, Ill. Interconnection of operating lever and door, permitting adjustment of lever to prevent creeping of car.

1,195,130. Electric Switch. F. Barr, New York, N. Y. For lamp socket.

1,195,137. Light-Dimming Mechanism. A. Herz, Chicago, assignor of one-half to E. O. Schweitzer, Chicago, Ill. Connector has plug and socket at its ends with switch-controlled reactance between. (See cut.)

1,195,144. Lamp Fixture. H. D. McFaddin, East Orange, N. J. Structure of bracket supporting lamp and hood reflector.

1,195,157. X-Ray Tube. P. A. Farrelly, assignor to Green & Bauer, Hartford, Conn. Relates to mounting of anode.

1,195,163. Convertible Ringing Control for Telephone Systems. G. D. Wolf, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Relates to ringing keys and connections.

Reissue 14,181. Magnetoelectric Machine. J. B. Frawley, assignor to Berkshire Magneto Co., Pittsfield, Mass. Original No. 1,160,995, dated Nov. 16, 1915. Of inductor-alternator type.

Reissue 14,183. Safety Fuse. H. A. Yates, assignor to Economy Fuse & Mfg. Co., Chicago, Ill. Original No. 1,028,173, dated June 4, 1912. Inclosed renewable fuse has reduced sections adjacent its ends so that on blowing the middle portion will drop out.

PATENTS EXPIRED.

The following United States electrical patents expired on August 22, 1916:

631,271. Telephone. J. Q. Black, Lone Rock, Wis.

631,277. Electric-Alarm Water Column. M. L. Bush, Lawrence, and C. F. Swain, Methuen, Mass.

631,278. Thermostat. J. Butcher, Jersey City, N. J.

631,289. Maximum-Demand Meter. W. C. Fish, Lynn, Mass.

631,290. Electric Meter. W. C. Fish, Lynn, Mass.

631,303. Electric Switch. G. W. Hart, West Hartford, Conn.

631,304. Snap-Switch. G. W. Hart, West Hartford, Conn.

631,313. Electric Arc-Lamp. F. McIntosh, Schenectady, N. Y.

631,316. Device for Lighting Lamps by Electricity. S. M. Meyer, New York, N. Y.

631,322. Oxidant for Electric Batteries. L. Pagent, New York, N. Y.

631,339. Clutch for Electric Arc-Lamps. H. C. Spinney, Lynn, Mass.

631,343. System for Electric Metering. E. Thomson, Swampscott, Mass.

631,354 and 631,355. Telephone Receiver. J. A. Williams, Cleveland, O.

631,356. Magneto-Electric Telegraph. L. G. Woolley, Kenton, O.

631,360. Electric Heater. J. L. Creveling, New York, N. Y.

631,361. Trolley-Pole Catcher. C. A. Davis and H. M. Wilson, Somerset, Mass.

631,395. Jacquard Card-Punching Device. T. David, Lyons, France.

631,421. Facsimile Telegraph. W. P. Dunlany and T. Mills, Cleveland, O.

631,452. Column Printing Telegraph. J. E. Wright, New York, N. Y.

631,453. Telegraphic Relay. J. E. Wright, New York, N. Y.

631,454. Telegraph Transmitter. J. E. Wright, New York, N. Y.

631,467. System of Electric Metering and Apparatus Therefor. R. M. Hunter, Philadelphia, Pa.

631,468. Method and Apparatus for Producing Alkali Salts. C. Kellner, Vienna, Austria-Hungary.

631,491. Preventing Accidents on Drawbridges to Electric Cars. S. L. Phillip, Washington, D. C.

631,497. Electric Switching System. J. Brennan, Jr., St. Louis, Mo.

631,503. Electric Meter. C. D. Haskins, Newton, Mass.

631,505. Audiphone. R. Hutchinson, Mobile, Ala.

631,511. Electric Clock. A. F. Poole, Washington, D. C.

631,518. Electric Motor or Generator. J. Burke, New York, N. Y.

631,555. Thermostatic and Electrical Ventilating Device. O. L. Billings, Philadelphia, Pa.

631,596. Attachment for Electric Trolleys. H. Stuempfle and J. Delane, Terre Haute, Ind.

631,623. Electrical Fountain Brush. C. Diehl, Philadelphia, Pa.

631,628. Electric Lighter for Incandescent Burners. C. T. Farnham, Manchester, N. H.

631,631. Electric Alarm-Clock, J. Goldenberg, J. Komow and L. Gutterman, New York, N. Y.

631,633. Electric Push-Button Cutout. J. I. Gunther, New York, N. Y.

631,649. Electric Arm-Lamp. G. R. MacIntire, New York, N. Y.

631,700. Illuminated Street-Car Sign. E. E. Dodge, Providence, R. I.

631,733. Electrode for Electric Belts. F. G. Bonfils and J. D. Alkire, Jr., Denver, Colo.

631,748. Electric Lighting Device for Incandescent Gas-Burners. S. M. Meyer, New York, N. Y.